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Rock Products

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Pennsylvania roofing granule plant—a little known branch of the quarry industry

Roofing Granules Industry in Southeastern Pennsylvania*

A Little Known, but Important Branch of the Rock Products Industry

By R. W. Stone
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PENNSYLVANIA is the greatest mineral producing state in this country. The annual value of her mineral products is about 1¼ billion dollars, or greater than that of any three other states. This production is largely coal, natural gas, cement, petroleum, clay products and stone, and includes many lesser minerals and mineral products. One of these is roofing granules.

The Pennsylvania Geological Survey endeavors to keep in touch with the development of the various mineral industries, but it would require a much larger staff than present appropriations permit to know by personal observation what is going on in all branches of mining in the state. The writer visited some of the roofing granules plants in 1922 and again in May, 1928, and found that a notable development has occurred in that time. Some plants have discontinued operations, one has been rebuilt on a much larger scale at another site, one is being enlarged and has changed from quarrying to mining.

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History of Some Operations

The Greenwich Manufacturing Co., at Lenhartsville, Berks County, formerly producing green slate granules and later slate dust for linoleum filler, has discontinued operations.

The Atlas Mineral Products Co., at Albany, Berks County, first made red slate granules, but after the World War made green rock flour, used largely for filler in gypsum wall plaster, and in asphalt products. The plant burned a year or two ago and this operation has been discontinued.

Gorsuch Brothers, Inc., manufactured black slate roofing granules at Peach Bottom Station, Lancaster County, for several years, but had to discontinue in 1927 when the completion of the Conowingo dam on Susquehanna River raised the water level and flooded the property.

The Shelden Slate Products Co. crushed greenstone for roofing granules at Iron Springs, Adams County, prior to 1920, and for two weeks in 1922. Since then the plant has been idle, and within the last year the property has been sold and the machinery removed.

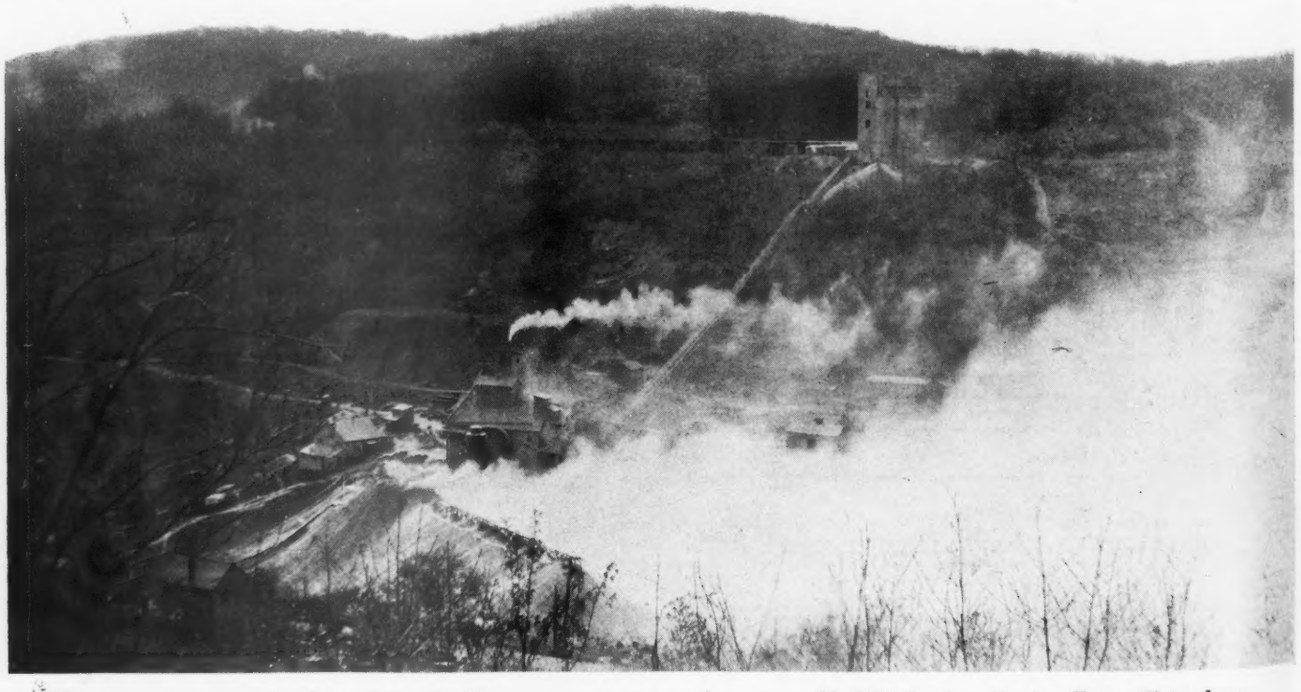
This leaves now in operation only the Advance Industrial Supply Co., at Greenstone, Adams County; the Funkhouser Co., with plants at Charmian and Delta, and the Octararo Stone Co., Nottingham, Chester County.

The Why of the Roofing Granule Industry

The natural desire of home builders for a non-inflammable roof, and the comparatively high cost of roofing slate and tile, have resulted in the production of a roof covering that is fire-resistant, light weight, easily attached, and of pleasing color. This has resulted in the production of roofing granules.

Roofing granules are crushed rock of various kinds which are made for imbedding in an asphaltic or other matrix to form roofing material. This roofing may be in the form of shingles or rolled sheets, or it may be poured in place.

The shingles and sheets are felts which are impregnated with asphalt in which fine



The greenstone granule plant of the Funkhouser company seen from near Gladhill Station, Penn. The mill is shown near the center of the picture with the quarry just above it and the waste pile below. The storage bins and loading tower are shown on the railroad up the hill

The greenstone quarry of the Advance Industrial Supply Co., at Greenstone, in Adams county, Penn.

The recently opened greenstone quarry of the Advance company, showing the side-hill method of operation

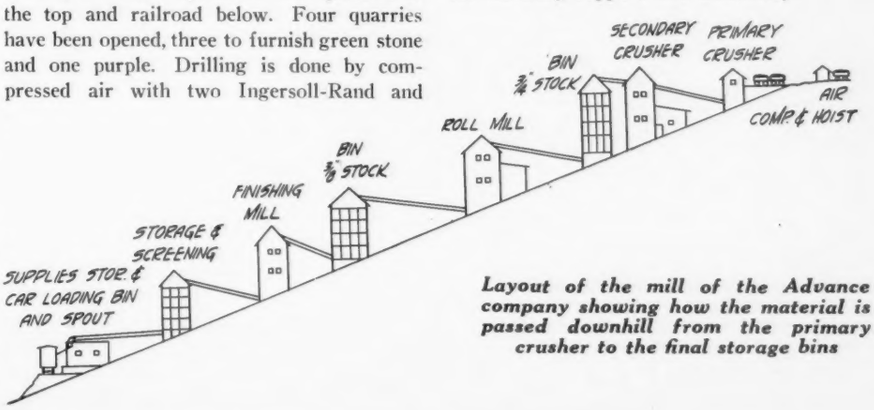
crushed stone is embedded. The crushed stone, or roofing granules, as a rule are made to pass through a 10-mesh and be retained on a 35-mesh screen. Color is more important than hardness or shape of the granules. An emerald green is more pleasing than yellowish green, and deep-colored greenstone is preferred to harder and lighter colored epidosite. Red or purple rhyolite or slate that is non-fading is better than more brilliantly colored rocks that contain a little lime and will fade on exposure.

Present Pennsylvania Producers—The Advance Industrial Supply Co.

When in 1913 the Advance Industrial Supply Co. opened a greenstone quarry at a cut on the Western Maryland Railroad on Miney Branch in South Mountain, an industrial development of no mean proportion had its birth in a wilderness. Wooded mountains are on all sides; and even today, 15 years later, when the mills employ 150 men, only so much of the cove has been cleared as is needed for the quarries and mills. Although a considerable summer colony occupies the mountain a mile away and several trains circle the cove daily, yet the South Mountain area is so wild that deer are frequently seen around the quarries.

The Advance Industrial Supply Co. quarried greenstone and purple rhyotite and made granules at a plant at Gladhill Station (Greenstone P. O.) from 1913 to 1926. In that time the plant burned twice; and most of the readily accessible and desirable stone was exhausted. A new plant was built at the head of the cove, one-half mile from the old site, and began operating in April, 1926. This is a hillside operation with quarries at the top and railroad below. Four quarries have been opened, three to furnish green stone and one purple. Drilling is done by compressed air with two Ingersoll-Rand and two Gardner-Denver jackhammers, using hollow steel, 1-in. drills. The quarry product is loaded by hand in 2-ton side-dump cars and drawn by gasoline locomotives to the primary crusher. These locomotives have Ford motors mounted on light railway trucks. The standard type of radiator is replaced with a 20-gal. steel water tank. Four or five loaded cars make up a train.

The air compressor house is at the top of the hill near the first quarry and includes a reserve engine and a hoist for drawing cars out of one quarry, and for operating cars on a narrow-gage track that extends from the railroad to the top of the hill and is used for handling supplies and machinery.



Layout of the mill of the Advance company showing how the material is passed downhill from the primary crusher to the final storage bins

The engine house and mills are built with steel frames and have corrugated iron sheeting and roofs; the bins are of heavy wood construction.

Crushing by Stages

The primary crusher is an Allis-Chalmers No. 5 gyratory. A belt conveyor takes the broken stone to the top of the next mill,

The Advance plant showing, from left to right, the secondary crusher building, bins for ¾-in. material, roll mill, and storage bins for ⅜-in. material

Another view of the Advance company plant showing the secondary crusher building and ¾-in. storage bins at the right, with the roll mill below

Purple rhyolite quarry of the Advance Industrial Supply Co., showing methods of quarry operation

Motor used in the quarry of the Advance company for hauling cars to the crushing plant

which contains two Telsmith No. 3 gyratory crushers. From these the ¾-in. rock goes to storage bins, and thence to the roll mill, which has four pairs of 24-in. rolls of the company's own make. The next building below is a storage bin for ⅜-in. rock. Below it is the finishing mill with four pairs of 24-in. rolls and three Sturtevant vibrating screens. From these the rock goes to the finished storage bins. Before shipment it is re-screened by four rotary screens 10 ft. long, covered with 34-mesh wire cloth. The product passes a 9-mesh screen, and stays on a 34-mesh. A belt from these storage bins carries finished granules to a 1-ton bin, from which a metal spout feeds on to an electric car loader.

The plant is operated by six Penn-Severin semi-Diesel 60-hp. oil engines, and one 25-hp. for generating current and pumping oil and water. Fuel oil is delivered from tank cars directly into a 12,000-gal. tank beside the railroad, and is pumped up to the engines. A mountain spring feeds to a reservoir at the lower level of the plant. Water is pumped from it to a reservoir at the top of the hill, giving gravity distribution throughout the plant. Clean air for the engines is conducted from below the plant by a 2-ft. sheet-steel conductor. A private telephone system facilitates communication throughout the plant. The plant finishes about 120 tons of granules daily and operates the year around. About 70 men are employed, the quarrymen working one 10-hour shift and the men in the finishing mill two shifts. The company leases 1200 acres and pays a royalty per ton. Both green and purple granules are made at the plant; the change from one color to the other necessitates cleaning the bins in succession down the hill. Because of the storage capacity in the bins, the quarries may deliver purple rock to the crushers for two or more days while the finishing plant is discharging green granules.

The granules are shipped in bulk in box cars to manufacturers of roofing in the United States and Canada east of Chicago.

The officers of the Advance Industrial Supply Co., miners and manufacturers of roofing granules, 111 West Washington Street, Chicago, Ill., are S. G. Wright, president; L. F. Wright, vice-president; E. E. Stephenson, secretary and general superintendent; F. H. Gray, treasurer. Besides the plant described here, this company has mills at Bellewood, Ill., Granville, N. Y., Marquette, Mich., and Pacific, Mo. M. W. Wills is superintendent of the plant at Greenstone and showed the writer all the points of interest except the aforementioned deer. However, he did exhibit his apple orchard planted close around his house so that he can protect it from night-feeding bucks and does. This is "no kidding," for the legal kill of bucks in Pennsylvania in 1927 was 15,000, and in 1926 about 13,000, Pennsylvania through the work of its Game Commission having become one of the best hunting regions in the United States.

The Funkhouser Company Plant

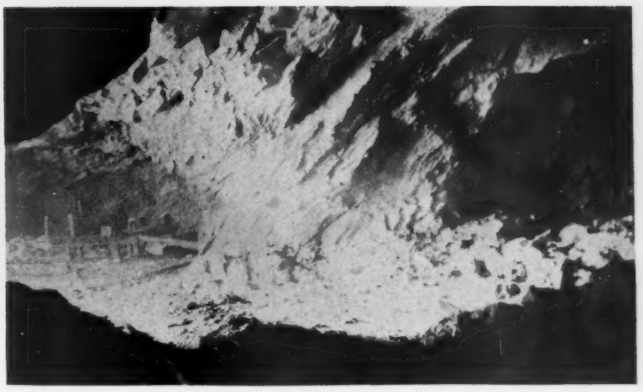
The Blue Mountain Stone Co. and the Green Roofing Stone Co., both of Hagerstown, Md., opened quarries and built crushing plants along the railroad near Charmian, Penn., and across the cove from the Gladhill Station in 1918-19. In 1922 these two were combined and operated as the Blue Mountain Stone Co., one of several quarrying operations of R. J. Funkhouser and Co., Hagerstown, Md. In 1928 the variously named and located stone companies were consolidated as the Funkhouser Co., and this name will be used here, although the development has been done by the Blue Mountain Stone Co.

Two quarries have been abandoned and one mill dismantled and operations concentrated in one mill now 10 years old. The company drove drifts into the hill from the main quarry in 1923, when overburden became too heavy, and sunk a 350-ft. inclined shaft in 1925. All greenstone is now mined underground from drifts and underhand stopes, which method of mining is equivalent to underground glory holes. Two levels have been driven from the shaft. The upper level or drift from the quarry extends about 600 ft. to the property line at the railroad. Drilling is done with Chicago Pneumatic Tool Co. and Ingersoll-Rand jackhammers

Pile of waste greenstone dust at the Advance plant

Loading greenstone granules at the Advance mill

Three drifts of the greenstone mine of the Funkhouser company at Charmian, Penn.



Within the greenstone mine of the Funkhouser company at Charmian

using hollow-steel, 1- and 1¼-in. drills. An Ingersoll-Rand 1800 cu. ft. air compressor is operated by purchased electric power. About 500 tons of rock are produced daily, that from the first level being delivered to the crusher in side-dump cars drawn by gasoline motors, and that from the lower levels is hoisted in two skips on parallel drums. Skip capacity is 79 cu. ft. The skips are raised by an Allis-Chalmers electric hoist and dump direct into a Gates No. 6 gyratory crusher.

From this primary crusher the rock moves as follows: On a 16-in. belt, through a 36-in. Symons horizontal disc crusher, elevator, screen scalping out 1-in. rock, return to two 24-in. horizontal disc crushers, forming a closed circuit. From storage bin by belt conveyor and elevator, through a vertical stack dryer with baffles like the old Edison type dryer, to belt conveyor, through 36x16-in. Power and Mining Machinery Co. rolls, into elevator, over a two-deck "Hum-mer" screen, style 31, scalping ½-in. rock. Oversize goes to preceding roll, forming another closed circuit.

Rock passing the "Hum-mer" screen, under ½-in., goes to 30x16-in. Traylor rolls, to elevator, over preceding "Hum-mer," forming the third closed circuit. Rock under ¼-in. goes from the screen by elevator to four two-surfaced, style 31 "Hum-mers" on a 30-deg. pitch, with 8-mesh wire cloth on top, and 30-mesh on the bottom. Rock retained between these two meshes is the marketed product. Oversize from these four screens passes to 30x16-in. balanced Sturtevant rolls, then to elevator, forming the fourth closed circuit. The minus 30-mesh is carried to a waste pile by belt conveyor.

The marketed product goes by elevator to revolving screens and then over two "Hummers" for final scalping and cleaning, then into a storage bin at the mill, from which it is carried on a series of belt conveyors, approximately 1200 ft. long, with a vertical elevation of about 250 ft. to an elevator and loading tower on the railroad above the mill.

At the loading tower the finished product goes either into two 1000-ton concrete storage tanks or direct into box cars, passing over another "Hum-mer" screen for final cleaning to insure positive grading. The product is delivered by a metal spout to an electrically operated car loader.

About 250 tons of granules are made daily. Most of this is used by manufacturers of roofing material. Some of the coarser product is sold for terrazzo and for facing concrete blocks. There is no market for the fines or for the dust blown out by the dust-collecting system, and a huge pile has accumulated below the mill.

Although greenstone granules are the principal product, purple granules are made on demand. The rock, a purple rhyotite, is taken from a small quarry on Miney Branch, south of the highway.

About 70 men are employed regularly. The mine operates on one 10-hour shift and the mill on two shifts. The mill is operated by purchased electric power. The water supply is pumped from a well to a wooden tank on the hillside above the mill.

Storage for greenstone granules at the Charmian plant

In May, 1928, when the writer visited the plant at Charmian, foundations were being prepared for a new steel and concrete mill which was expected to be in operation by September. It will stand alongside the present wooden mill.

R. J. Funkhouser, president of the company, maintains an office in New York City;

The headframe over the mine and the mill of the Funkhouser company at Charmian

The Funkhouser plant with the mine headframe at the left, and the dust collecting system beside the mill to the right

The granules storage bins at the Charmian plant, above, and the compressor house at the right

E. N. Funkhouser, vice-president and secretary, and E. H. Nichols, chief engineer, are at the general office in Hagerstown, Md. M. L. Funkhouser is resident manager of the plant at Charmian, and Ed. Weaver, formerly with the Tennessee Copper Co. at Ducktown, Tenn., is mine superintendent.

The Funkhouser Co., engaged in mining, milling and refining color surfacing for roofings, has plants in several other states, including one other in Pennsylvania. This is at Delta, York County, in the Peach Bottom slate district.

In 1922 the Blue Mountain Slate Co., holding a lease on 79 acres of slate land one mile north of Delta, began making dark blue granules from slate taken from quarry dumps. Subsequently a cut was made through the hill into a slate quarry close to the mill, giving a good grade for a tram road, as the quarry floor is higher than the primary crusher. For several years slate for the mill has been obtained by sinking drill holes 80 ft. deep in the extension of the slate band on two sides of the quarry, blasting down the face, and loading with three Marion caterpillar electric shovels. Two Plymouth gasoline locomotives haul quarry cars to the mill. Three Fairbanks-Morse oil engines, direct-connected to generators, furnish the power used in the quarry and mill.

The primary crusher is an Allis-Chalmers 30-in., Superior-McCully gyratory. Broken stone goes from it to a bin, to a Williams W1 "Jumbo" hammer mill, and by belt under the highway to a stack dryer in the main mill. The dry rock is elevated to a bin from which it goes to another Williams hammer mill and to two "Hum-mer" screens. The oversize from the screens goes back to the Williams mill and that passing the screen to concrete storage tanks. As needed the material is drawn from the tank, goes through a Jeffrey ¼ hammer mill, to screens, to a Jeffrey ⅛ hammer mill, to "Hum-mer" fine screens, to storage bins. On the way from these bins to bulk loading in railroad cars, the granules pass two "Hum-mer" screens to take out dust. A spur of the Maryland and Pennsylvania Railroad places cars in the plant.

Most of the product is shipped in bulk, but granules are also bagged for customers who have no storage bins. The dust throughout the plant is collected by a dust arrester and deposited on a waste pile, as there seems to be no market for this abundant product.

About 50 men are employed at this plant and the output is around 300 tons of granules per day.

Octararo Stone Company

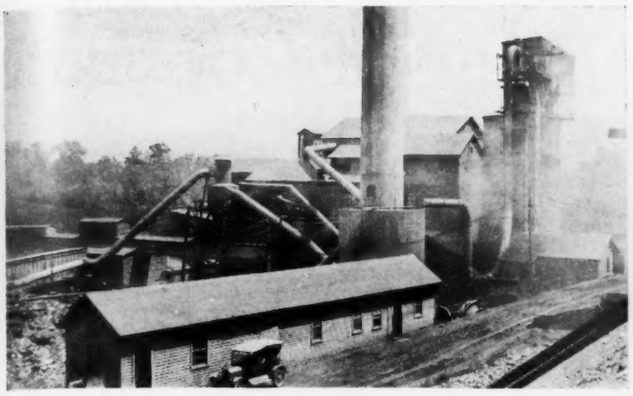
The Octararo Stone Co., Nottingham, R. D., is owned and operated by W. B. and C. M. Geiger and Charles Watt. The quarry and plant are on the west bank of Octararo Creek, ¾ mile above the Pennsylvania-Maryland state line in Lancaster County. The quarry was opened originally by A. H. Burkholder, of Quarryville, for road material, and discontinued when the nearby state highway was completed in 1924. When seen by the writer in 1927 two small quarries in serpentine were producing two shades of green stone, a dark green, called oak leaf, and a light green, called emerald. Drilling is done by compressed air. The quarry product is hauled 200 yd. in auto trucks to a simple plant consisting of two small crushers, a roll crusher and a cylindrical screen making four sizes, ¼-in. to sand. The product, amounting to about 30 tons daily, is sacked and hauled to Quarryville, Penn., and Conowingo, Md., for shipment. It is sold for use mainly in the construction of terrazzo floors.

Conclusion

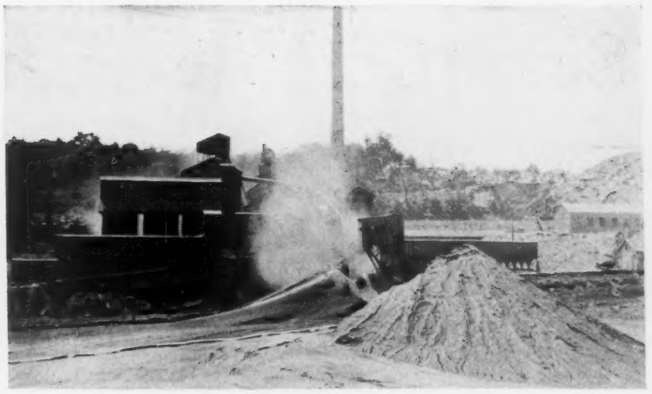
The production of roofing granules would seem to be a fairly simple operation and a profitable business so long as the market is strong. As the manufacture of roofing materials has advanced, however, users of roofing granultes have increased their specifications until the producer must be constantly alert to meet the requirements. Color must be permanent and uniform. Size is limited to certain meshes and dust must be excluded. The manufacturer must test frequently with Tyler standard screens to make sure that his product keeps within the range of sizes. Some users even specify a very low percentage of lime in the rock.

In the manufacture of granules approximately one ton of dust is made for every two tons of granules. This cannot be avoided and, as there is no market for the dust, it accumulates at the plant. If it is allowed to blow away as it spills from the conveyor on to the waste pile it becomes a nuisance to neighbors and may at times be a menace. If it is allowed to wash into a stream, it fouls the bed and banks, drives out the fish, and is a source of complaint from riparian own-

Quarry of the Blue Mountain Stone Co. (now the Funkhouser company) at Delta, Penn., showing the electric shovel and gasoline locomotive



Delta plant of Blue Mountain company, showing dust collecting system, with primary crusher at right, loading bins to the left



Slate granules plant at Delta, with the waste dust pile in the foreground and the quarry behind

ers and anglers. These and other considerations make the task of a granules producer, and particularly of the plant superintendent, not all "beer and skittles."

Standardization of Crushed Stone Sizes

STANDARDIZATION of crushed stone sizes makes little progress because engineers do not wish to use other than the sizes to which they have been accustomed. Also because so many types of bituminous roads have been developed, the advocates of which call for variations in sizes which are of "academic rather than practical significance." These are the reasons given by F. H. Jackson, engineer of tests of the U. S. Bureau of Public Roads, in an article in the October *Constructor*.

The article describes the work of the road materials committee of the American Society for Testing Materials to prepare tentative specifications for standardized sizes of crushed stone. The problem involved something more than agreeing on the sizes most used. The whole matter of screening had to be studied from the practical producer's standpoint. In this study the results of an investigation of screening by the U. S. Bureau of Public Roads, made several years ago, formed the basis of the committee's work.

The conclusions made from this investigation are given rather fully in the article (and the interested reader is probably familiar with them). That which particularly affected the problem of standardization was that a tolerance of 5% oversize and 15% undersize should be allowed when the practical work of a revolving screen was compared with a laboratory screen of the same size of opening. This was adopted by the committee.

The committee decided that the simplest and most practical way to designate sizes was to specify upper and lower limits as ¼-in. to ¾-in. With each of these designations were given the tolerance of over and undersize mentioned above and specifications of intermediate sizes.

On the basis of five primary sizes, the committee proposed to divide the crusher run (taken as 0 to 3½-in.) as follows: 0 to ¼-in., ¼-in. to ¾-in., ¾-in. to 1¼-in., 1¼-in. to 2½-in., 2½-in. to 3½-in. The first size is the usual screenings; the second, ½-in. to ¾-in. is commercial "half-inch" stone, used in bituminous macadam and bituminous concrete and as a surface dressing. The third, ¾-in. to 1¼-in., is commercial "inch stone" used in the intermediate course in bituminous macadam, in bituminous concrete and as aggregate in portland cement concrete where the maximum size is to be 1¼-in. The fourth, 1¼-in. to 2½-in., is proposed for use in macadam (water bound or penetration) road construction where the course is less than 3-in. deep. The largest size, 2½-in. to 3½-in., is available for use as a base course in macadam (both types) for courses over 3-in. in depth.

These specifications have been tentatively adopted by the American Association of Highway Officials, the Federal Specifications Board and the Asphalt Association. With the exception of the Federal Board they have been adopted as typical specifications and are not at all mandatory. The conclusion of the article seems to hold out little hope for their more widespread adoption at the present time.

Slate Production in the United States

THE PRESENT ACTIVE SLATE-PRODUCING DISTRICTS of the country, according to the United States Bureau of Mines, Department of Commerce, are the Monson district of Maine; the New York-Vermont district, including Washington County, N. Y., and Rutland County, Vt.; the Lehigh district, including Lehigh and Northampton Counties, Penn.; the Peach Bottom district, including Lancaster and York Counties, Penn., and Harford County, Md.; Berks County, Penn.; and the Buckingham County (Arvonia) and Albemarle County districts of Virginia. These districts produce roofing slate and mill stock; some of them also produce roofing granules and slate flour. Roofing granules and flour are also produced in California, Georgia and Tennessee.

Pennsylvania is the largest producer of slate (exclusive of slate granules) in the United States and also produces a greater variety of slate products than any other state, although Maine and Vermont both outrank it in output of electrical slate.

Colored Slates

The New York-Vermont slate district is practically continuous. These two states produce all of the colored slates used for roofing. Red slate is the chief product of the New York quarries, but they also produce, with those of Vermont, the various green, purple, variegated, mottled, and "freak" slates in demand for roofs.

The output of the New York quarries is chiefly for red granules with a small output for roofing slate and slabs for walk ways, flagging, etc.

The Vermont quarries produce roofing slate, mill stock, granules, and slate for walks, etc. The colors are in wide variety and combinations of green and purple and are generally classed as green, unfading green, unfading mottled green and purple, weathering green (sea-green), purple, variegated, and "freak." There are also black and gray varieties. Most of these granules manufactured are green. Much of the roofing slate produced in Vermont is, as in New York, quarried and shaped by owners of small quarries that are worked at irregular intervals. This slate is generally of unusual color and specially sized and is sold through operators of large quarries or through dealers. On account of the variety of colored slates found in the district much of the roofing slate commands a high price on the building material market.

Detailed statistical information in regard to this industry is given in the Bureau of Mines publication, "Slate in 1927," by A. T. Coons, which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of five cents.

Scientific Merchandising of Concrete Aggregates

The Concluding Discussion of Methods of Selling Aggregates Through Comparisons of Whole Construction Costs

By Stanley M. Hands
General Manager, River Products Co., Iowa City, Iowa

ADOPTION of the cement-water ratio is beneficial to producers of concrete aggregate. Architectural and engineering specifications that will permit the use of a wide range of sizes and grading of aggregates encourage the producer to utilize his raw materials fully. The use of pit-run or slightly processed aggregates, which can be produced cheaply, may result in economy, even though more cement is required.

Concrete may be pictured as a mass of aggregates bound together with a cement-water paste. By careful grading of the aggregates, the mass can be made up of a large percentage of aggregate material in which there is a small percentage of voids. These voids are to be filled with just enough of the cement-water paste to tie the whole together.

If the voids are just filled with paste there will be no slump, but each additional unit of the paste begins to create a slumping tendency of the aggregates, and the stiffness is gradually overcome. The proper amount of additional cement-water paste produces the proper workability. The liquid-like action of the concrete is obtained by adding the cement-water paste and not water only. The strength of the concrete remains the same regardless of the amount of paste which is added, but the slump varies with the amount of paste.

Arriving at the True Economy of Mixed Concrete

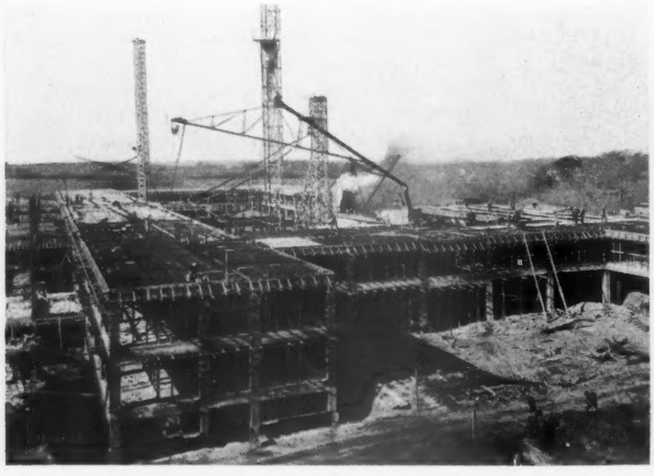
If the price of all aggregates were the same, regardless of the gradation, the cheapest aggregate would be determined by the amount of cement-water paste required to get workability. That aggregate which gave the proper slump with a minimum paste would be the cheapest.

Economy in the use of the paste is the basis of determination of concrete manufacturing methods. There are few if any deposits of sand and gravel that are so graded that a minimum paste requirement could be secured from the natural deposit. Again, it may be that the cost of resizing the material will result in added costs of production that are in excess of the saving in paste cost. The balance between these cost elements will determine what the standard of gradation for each plant should be.

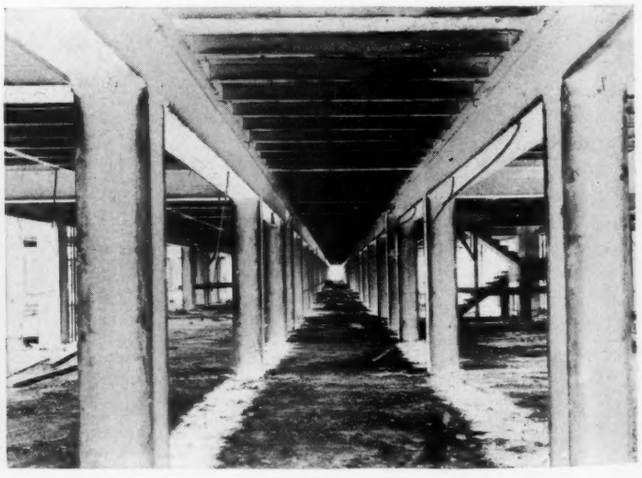
In certain localities the abundance of sand and crushed stone very properly makes the gravel production of no consequence in terms of volume. However, the sand price usually offsets any disadvantage in these deposits and, further, the small amount of gravel produced usually finds an outlet to dealers or to small jobs where the prices are better. Local market conditions may offer an outlet for the surplus sand and roofing gravel, in which case the producer could utilize his small percentage of 1½-in. sizes to mix an aggregate requiring a minimum of cement. However, such a condition very seldom exists unless it be in localities where there are crushed stone operations and balanced markets.

In some localities the sand and gravel operators do not attempt to sell coarse aggregate in competition with the stone producer, but concentrate upon the production and sale of various sands. The stone producer reciprocates by making an aggregate with such characteristics that when mixed with the sand a minimum paste is required. This joint selling of fine and coarse aggregate is perhaps the most profitable condition that could exist in the concrete aggregate business.

The amount of water-cement paste required for the mixed aggregates will vary with the gradation of the combined aggregates and with the slump required for the work. Concrete mixes should be determined on a basis of the cost of production, and that



The mixing plant is located at the foot of the center tower; concrete is chuted from the top of this tower to the two other towers where it is again hoisted and then chuted to the floor hoppers. The building was so large that one tower would have been impracticable. There was no segregation in the chutes



One mixing plant and three towers produced this concrete. Notice that there is no "pop corn." Some of the concrete was hoisted 75 ft. twice, and flowed horizontally 300 ft. Careful water control and uniform gradation of aggregates gave these good results

combination which offers the best outlet for the total product of a plant should be the standard for that plant. If the cost of concrete in place is determined, the sale price of the aggregates is computed and costs of production must be in line.

Sale Price Fixes Production Costs

The matter comes down in the end to the same basic principle that applies in other industries—the sale price determines the cost of production.

Tables of quantities like that on page 74, November 10, 1928, ROCK PRODUCTS, offer an idea of the variation in proportions of sand, cement, and coarse aggregates, and the effect of changing the percentage of fine aggregates in the total mix and holding the cement-water ratio constant. The first bracket shows a combination using approximately 33% sand, 67% coarse aggregate and 3679 bbl. of cement, the total making 2257 cu. yd. of concrete. The fifth bracket gives the same strength of concrete, but permits the use of 58% fine aggregates, 42% coarse aggregate and 4333 bbl. of cement (increase of 18% in cement), the total making 2257 cu. yd. of concrete.

Brackets 1, 2, 3, 4, 5 permit the use of fine and coarse aggregate in varying amounts between 33% sand and 67% coarse aggregate and 58% fine and 42% coarse aggregate with an increase in cement of 18%.

A producer may elect to furnish any of these proportions, and therefore his determination may be based upon his own operations and the percentage of fine and coarse materials in his raw materials. If he elects to furnish bracket 5 he must absorb the cost of a cement increase of 18%, and this must come out of the decrease in operating costs, that should result from the increased market for sand and the direct movement of a greater percentage from the pit to the consumer.

Each deposit and each market will determine which of these quantities is the best from the standpoint of production. Without specifications of this kind it is doubtful if the lowest cost of concrete can be obtained.

The Opportunity to Use Research

The producer of concrete aggregates will find the solution to many of his problems in the application of the technical laws of concrete. These new standards of concrete mixtures based on the cement-water ratio are not a detriment to the producer. The research engineers of the National Crushed Stone Association and the National Sand and Gravel Association should be frequently consulted in matters of materials and markets. I predict that these men will point out many things that will benefit the members. Research will turn out to be a money-maker.

The advantages of the use of the cement-water paste method of mixing concrete are these:

1. Wider choice of aggregates is made possible. By proper adjustments of the mixture, aggregates of widely varying characteristics may be employed under competent direction. The producer is thereby able to sell as concrete aggregate that part of his production that is lost or adds to his cost of production.

2. The amount and proportion of sizes of aggregates may be adjusted to secure the desired workability so long as the additional paste cost balances the saving in producing cost.

3. The improvement in workability and plasticity of concrete is made possible, and the considerable saving in labor cost to the contractor is a selling point.

4. Better workability and permissible adjustments in the paste required due to slight variations in the character of materials give uniform concrete and eliminate rejections at the plant or at the job.

5. Labor in placing and finishing is generally reduced. The aggregate producer is likely to participate in this saving.

6. Concrete made in this manner is more durable and shows more resistance to water and weather. This is a sales point for the owner, architect and engineer.

7. The source of friction between the architect, engineer, contractor and producer is eliminated. Friends are an asset.

8. Large factors of safety to make allowance for unskilled work are costly to the owner. The dollars wasted in this manner may be saved and put into other structures, thereby increasing the demand for concrete and for aggregates.

The mixing plant and concrete layout was designed by the aggregate salesman as part of the service. During the construction of the plant the comments of the contractors' bosses were many and various

Road Insurance

IF, in the morning mail, you find an insurance policy—or what looks like a policy—we venture to say that you will look further just to see what is really contained. Then if this "policy" can show you how it is possible to participate in worthwhile dividends, although you do not pay any annual premiums, it is likely that your interest will be further aroused and the "policy" will be kept in mind for future reference. Such a policy for "road insurance" has just been received from the John T. Dyer Quarry Co. of Norristown, Penn. It is folded in the form of a regulation policy, and the first page is bordered with the familiar shade of green ink so much used on policies, stocks and bonds. Inside is the announcement concerning the advantages of trap rock for road building, either as a concrete aggregate or as the base for a penetration road. It points out that building with this lasting material will pay dividends in decreased maintenance expense and, moreover, will insure against the road wearing out before its time.

The Dyer company has carried out its plan of popularizing its Birdsboro trap rock through direct mail advertising very efficiently. This "policy" is only one of its announcements to the public. A short time ago a Dyer blotter came to this office, and before that there were numerous folders and announcements describing some phase of the production or use of trap rock. This system of keeping the company's product before the public eye teaches that public, first, that there is such a material as trap rock, and, second, that it is just about the best stone for road building and similar uses that is known, according to well-known authorities quoted in the bulletins.

Estimate New Airport Construction at $8,500,000

IT IS ESTIMATED that more than $8,500,000 will be spent in the next year in airport construction in the United States. Eleven cities and counties have passed bond issues ranging from $25,000 to $5,000,000 for the work. In the last year more than $21,000,000 was appropriated for airport facilities. The use of cement, crushed stone and gravel figures largely in modern airport construction.

Sand Settling and Devices for Settling and Classifying Sand

Part XII—Commercial Forms of Hindered Settling Classifiers

By Edmund Shaw
Contributing Editor, Rock Products

THE division between the hindered settling classifiers used for separating materials and those used for separating grains of the same material into sizes is not sharp. With some modifications any machine used for one purpose may be used for the other. But there are forms that have been designed for one purpose only, so the division will be made there, taking first those devices used for separating two materials.

These have been gradually coming into use in the rock products industry, and some new forms have been developed in this industry. As time goes on and poorer bank

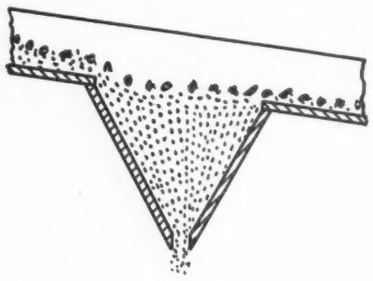


Fig. 57. Trough washer for coal, known in Europe as the rheolaveur

materials and ledges have to be treated there will be a greater use for them. But it is in the coal washing field that they have been used longest. Some of the coal-washing machines are already in use for washing sand and gravel and others may be adapted to such use with slight changes, so it will pay to study some of them briefly.

Separating Sandy Materials from Coal

The simplest of all coal washers is the trough washer. Originally this was a box, like a mason's mortar box. A laborer stirred up the coal and impurities with a little water and then allowed the mass to settle. The coal remained on top so that it could be skimmed off.

Then some genius discovered that the coal and impurities would stratify while the mixture was flowing (with water) down a trough, and the simplest continuous washer was invented, a trough over a conical or pyramidal box. The hindered settling action takes place in the launder or trough, for the cone below is only a settling device. It is shown in Fig. 57. Uusually there is a series of such boxes, and the device, which is still used in small European collieries, is called a *rheolaveur*.

The cone part has received much attention from inventors, and it has been given a great many forms and fitted with various discharge arrangements. The form shown in Fig. 58 is a hindered settling classifier below a trough, and it could be easily adapted to washing sand to free it from trash, coal and lignite. However, it would require considerable more attention (and then it would not do such good work) than some of the controlled machines which will be described later.

In these devices the trough or launder is just as much a classifier as the cone or box below. The critical part of it is the mouth, or entrance to the vertical part. A French inventor, Clement Clouwez, of Lille, France, has recognized this and invented an adjustable mouth. This consists of a pair of plates, which he calls "conjugated planes." These can be moved about to give almost any width or angle of opening desired. Fig. 59, taken from his United States patent drawing, illustrates this.

The man who has done the most for this method of separating coal from sandy materials in Thomas Chance, of Merion, Penn. He has made a thorough study of the subject, has written many important papers about it, and has secured many patents for machines and methods applying the principle. One of his accomplishments worth noting is that of raising the specific gravity of the sand and water mixture. With ordinary sands a specific gravity of 1.60 is about the limit. By carefully grading the sands so that the voids in the coarse grains were filled with fine grains he has succeeded in making a pulp which could be kept in agitation and maintain a specific gravity of 1.90. Many of his machines are in use in the Eastern coal fields washing coal from the mines and "culm," the refuse of older washeries.

One of his newest machines, a multiple form, is shown in Fig. 60. The first unit is an agitator (generally provided with stirring arms in his inventions) and those below it are hindered settling classifiers, with the exception of the last, which is a sump to catch the sand that has been used, so that it can be returned by a pump. Between the various units are shaking screens which separate clean coal from a mixture of sand and finer coal, and it is this mixture which is treated in the next classifier below in the series. Impurities accumulating in the sand mixture are removed from the bottom of the agitator or from the bottom of any classifier.

Hindered Settling Screw Classifiers

Hindered settling classifiers with screws to agitate the mixture of sand and water and take out the cleaned product are among those machines, mentioned in a preceding paragraph, which have been invented in the rock products industry. One of the best known is the Eagle Washer, made by the Eagle Iron Works, Des Moines, Iowa. It is made as a gravel washer and a sand washer. The two in appearance are much alike, but the sand washer is about a fourth longer and has a greater space on one side of the screw to permit the pulp to circulate more freely. If this is kept in mind, the drawing, Fig. 61, will serve as well for the sand washer as the gravel washer.

The main difference between this and some of the screw washers illustrated in Part VIII is that of the admission of water

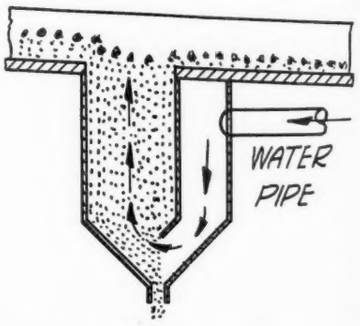


Fig. 58. Improved type of trough washer, which might be used for freeing sand of lignite

below the screw. This is done by means of the header pipe beside the casing shown in the drawing. A number of specially designed waterways lead from this pipe to the space below the screw. This enables the pulp to be brought to the hindered settling condition so that it will float lignite and trash, and as these are brought to the surface they are swept back to the overflow by the top cur-

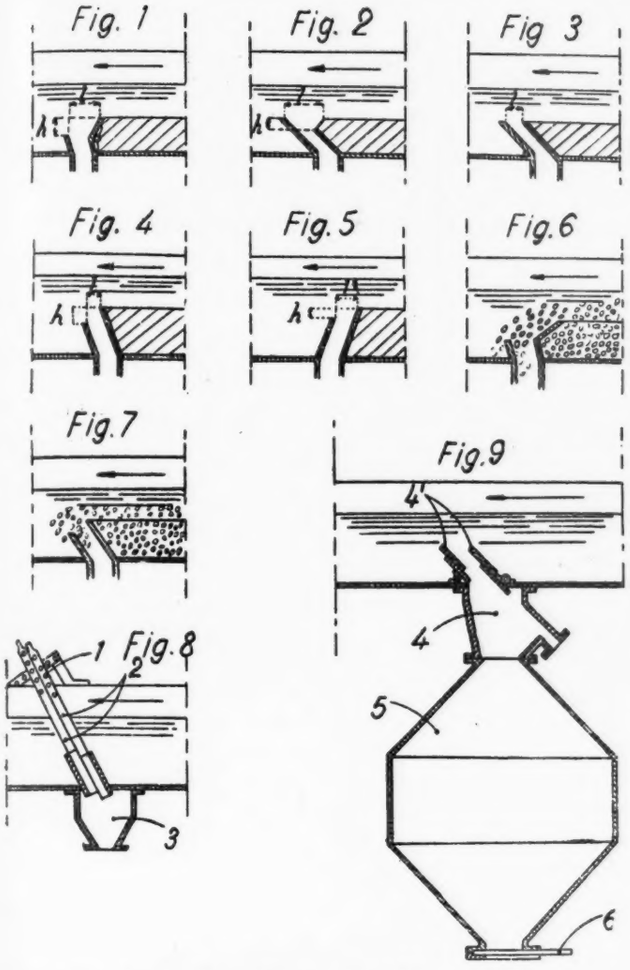


Fig. 59. A classifier with an adjustable mouth, showing some of the positions at which it can be set

rent created by the slope of the machine. Beside serving to agitate the pulp the screw assists in washing by scrubbing the grains and breaking up mud balls.

Many of these machines are in use throughout the United States for removing sticks, trash and mud balls, and along the Mississippi and the Missouri and other tributaries of the big river they have a special use in removing lignite from both sand and gravel. Their use might be profitably extended, for lenient local specifications permit the marketing each year of material which should be cleaned by some such device as this.

The Perfect classifier, Fig. 62, is a double screw machine with water admitted below the screws. It is made by the Perfect Classifier Co., Nashville, Tenn., and first used in the Cumberland River near Nashville, where the sand and gravel dredges have had a great deal of trouble with sticks, bark and other trash.

The most striking feature of this machine is the mechanical skimmer that skims off the floating material that accumulates at the overflow lip. Sometimes the floating material accumulates in such quantity as to block the overflow lip of the ordinary type, and the skimmer is useful in preventing this.

The Perfect classifier has been mostly used on the lower Mississippi, the Tombigbee, and other gravel and sand producing rivers in the South where lignite and trash are especially annoying.

By way of comparison, a German machine of something the same design as those just described is shown in Fig. 63. This is the Freygang washer. It is questionable if it could be called a hindered settling classifier, as all the water is admitted with the feed, although practically the same as hindered settling conditions may be obtained in this way. The overflow is taken out through a dome and pipe in the top of the casing which surrounds the screw. The article from which the cut was taken, by Alfred W. Searle, in the *Quarry Managers' Journal*, says that it will do good work on sand and gravel but that the capacity is rather limited.

Sizing Classifiers with No Automatic Features

Many forms have been given the hindered settling classifier intended to separate grains by sizes, so many that only a few can be mentioned here. The simplest is that shown in Part XI, Fig. 53, but almost as simple is the Anaconda classifier, Fig. 64, which has been much used in ore dressing plants.

Prof. Richards made an extended study

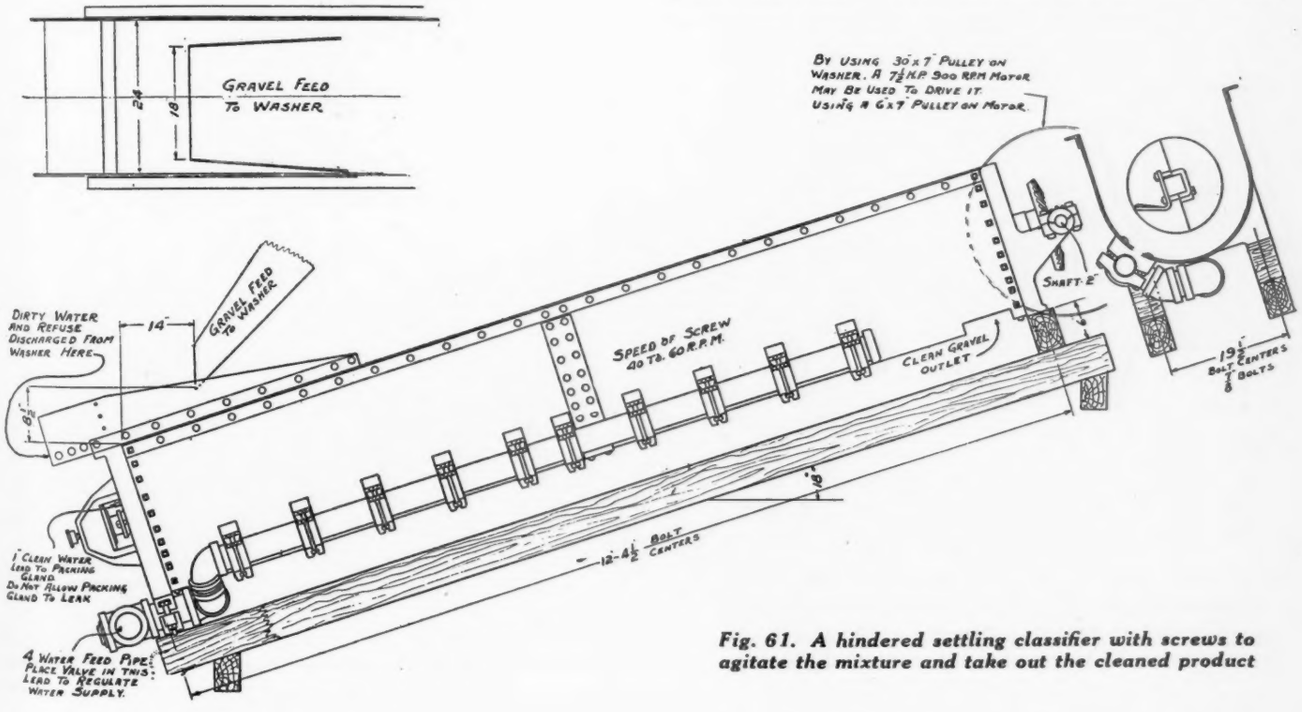


Fig. 61. A hindered settling classifier with screws to agitate the mixture and take out the cleaned product

of hindered settling classification and designed classifiers to meet various working conditions. Some of these are made as commercial machines by the Allis-Chalmers company and other machinery houses. One of his simpler classifiers is shown in Fig. 65, a sorting column with a constricted lower portion below. The rising current water is supplied through a vortex fitting, described in Part X. Fig. 66 shows another classifier* which the writer believes to be of Prof. Richard's design. It has been used in classifying silica sand to make blast sands and filter sands. A classifier much resembling it has been made for such work by the Smith Engineering Works, Milwaukee, Wis., and others. In this the rising current water is admitted through holes in the sides of the sorting column, as mentioned in Part XI.

The Deister cone baffle classifier (Fig. 67) admits the rising current water through holes in a ring around the bottom of the sorting column, but the unique feature of this classifier is the series of cone baffles

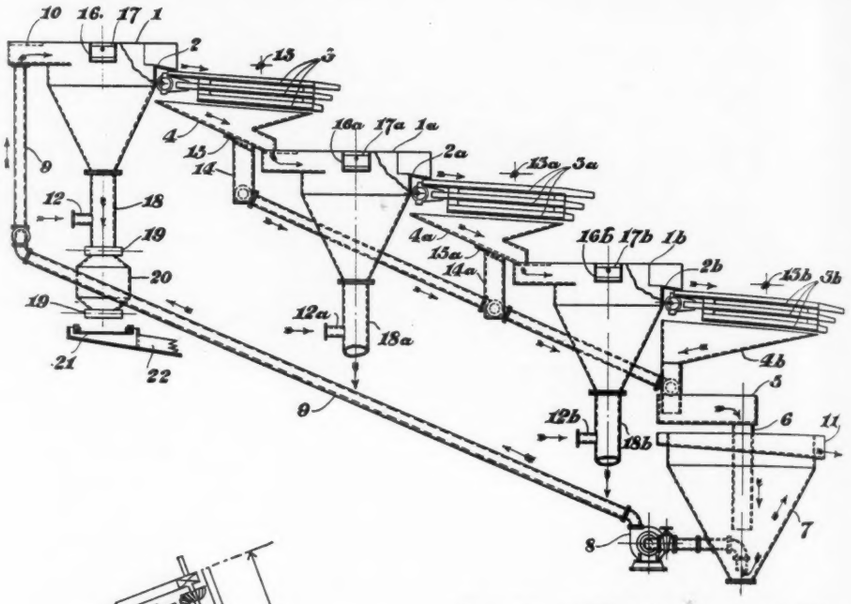


Fig. 60. Multiple form of classifier, the first unit of which is an agitator, and the succeeding units are hindered settling classifiers

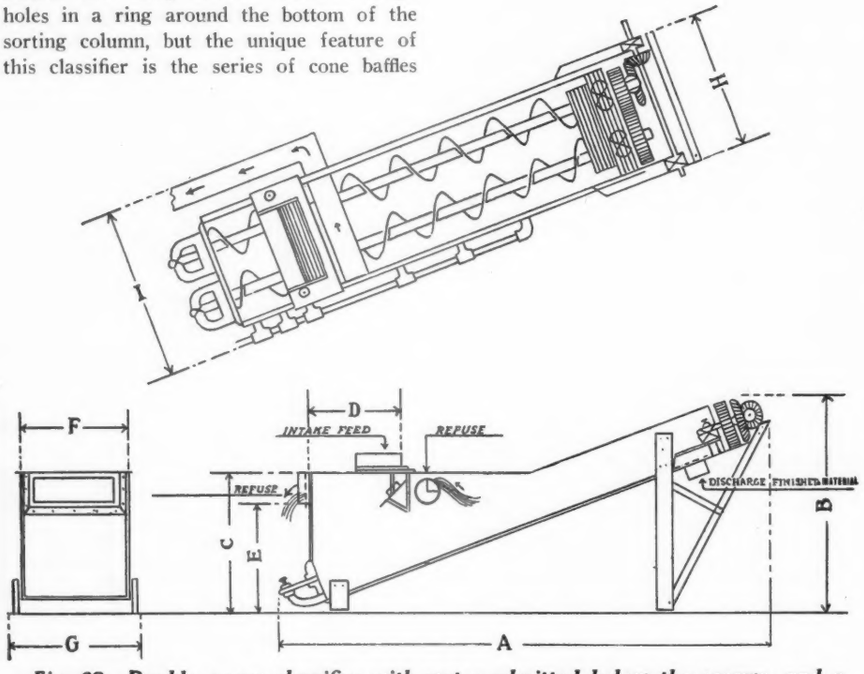


Fig. 62. Double screw classifier with water admitted below the screws, and a mechanical skimmer installed at the overflow lip

dressing plants and has also been used for classifying sand in sand and gravel plants. The makers, the Deister Machine Co., Fort Wayne, Ind., recommend it for washing sand free from clay and silt.

Draper's washer, or Draper's elutriator, originally designed for coal washing, is used in Great Britain for washing sand. The diagram, Fig. 68, shows it to be a tubular form of hindered settling classifier with a rotary valve at the bottom to discharge the settled solids. The air chamber shown is evidently intended to compensate for the shock and loss of water which occurs when the valve is opened. The pressure of the confined air will force water into the column when the valve is opened.

The idea of a mechanically operated valve in the place of a spigot has proved itself attractive to several designers. An American

placed in the column. These are provided with slots, large enough to pass the largest pieces easily, and the slots are staggered so that the particles descending have to take a zig-zag course to reach the spigot. The great advantage of this should be to separate a large piece from a smaller companion that was following it down in its wake, being thus protected from the action of the rising current. The slots also prevent agglomerations of grains from forming, and the passage of the water through so many passages breaks up channeling currents.

This machine has been much used in ore

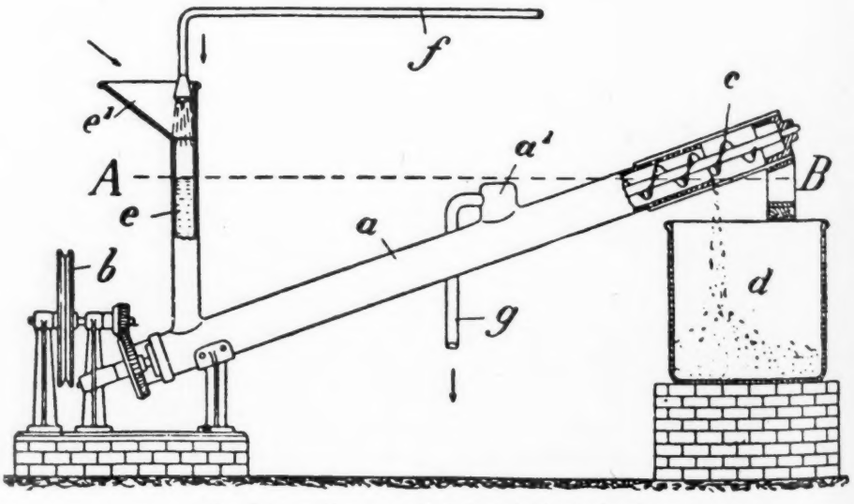


Fig. 63. A German hindered settling classifier

*The feature of this classifier is its construction. This was standardized, the bottom castings being the same for all sizes, and the sheet iron cone and overflow varied for fine and coarse separations. The construction is obtained by a thick plate with holes or a plate with short pipe nipples tapped into it. The illustration, and some of the others on this page, was redrawn from Taggert's "Handbook of Ore Dressing."

machine which uses it is the Richards-Janney classifier, the lower part of one cell being shown in Fig. 69. This has a ball valve at the bottom of the sorting column which is raised and lowered by a cam on a shaft above the body of the classifier. There is no compensation for the opening of the valve except that provided by the large body

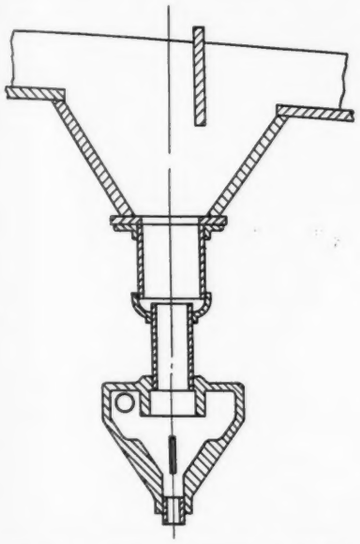


Fig. 65. Simple form of a classifier having a sorting column with a constricted portion

of water in the cone above. This machine has been much used in ore-dressing plants.

Classifiers Which Elevate the Discharge

The difficulty with discharge valves and orifices just spoken of has caused some designers to do away with them altogether, allowing the heavy material to settle and then elevating it by a drag or bucket elevator. Fig. 70, from the patent issued to Firmin Boscour, of Brussels, Belgium, shows one such machine. It has other interesting features, one of which is the way the rising

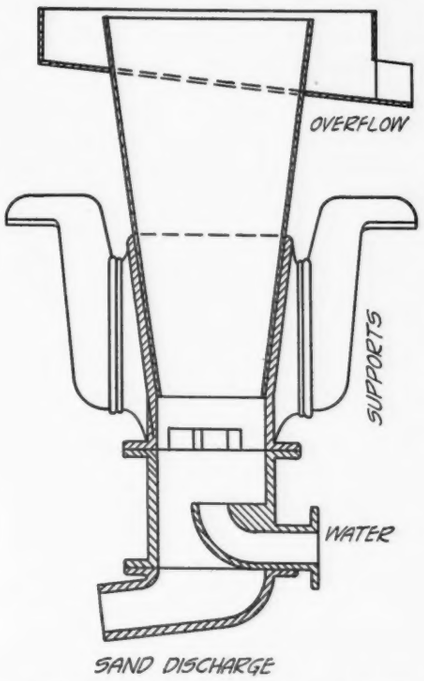


Fig. 64. Classifier largely used in ore dressing

current water is admitted at the side, coming under a movable baffle. The intention is evidently to give a sidewise movement to the current to help it to carry the lighter material (coal) to the overflow.

Another foreign machine which elevates the discharge is Field and Harrison's separator, and Fig. 71 shows it as taken from the British patent drawing. This is especially interesting, as it is the only machine of which the writer knows where the constriction at the bottom of the sorting column is varied by the feed. The variation is by means of a cone which is supported by a float in a chamber above the sorting column. Apparently this is intended to work as follows: The water and sand are fed into the

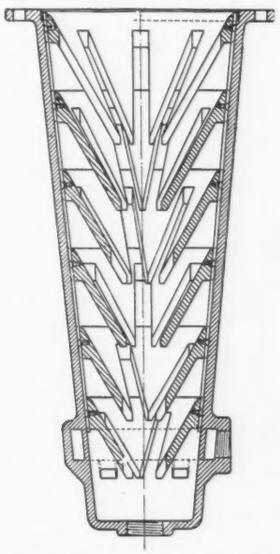


Fig. 67. A rising current classifier having a series of cone baffles placed in the column, as shown in the drawing to the right

float chamber, hence when the feed is entering the mixture there will be heavier than it is outside. This will cause the level to lower and the float to fall, allowing more sand to go out through the constricted passage. But this will also admit more water from the clear water supply in the elevator

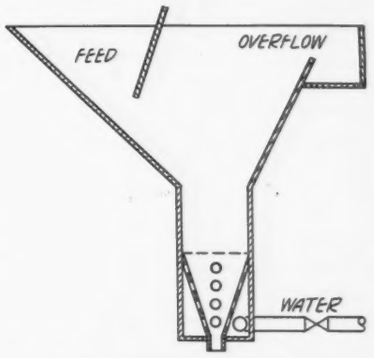


Fig. 66. Classifier which admits rising current water through holes in the constricted portion

leg and the net result will be to keep fairly constant conditions in the classifying column.

Automatically Controlled Classifiers

The advantages of automatic control of the discharge of hindered settling classifiers were discussed in Part XI. The writer knows of only two commercial machines

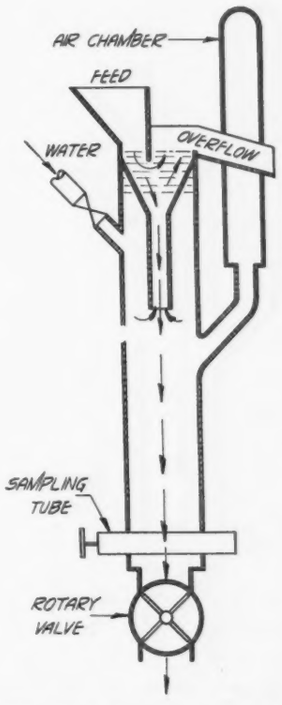


Fig. 68. Tubular form of classifier used in England for washing coal and sand

with such control, the Fahrenwald sizer and the Shaw classifier. The first governs the discharge in such a way as to maintain a constant specific gravity of the mixture in the hindered settling column; the second

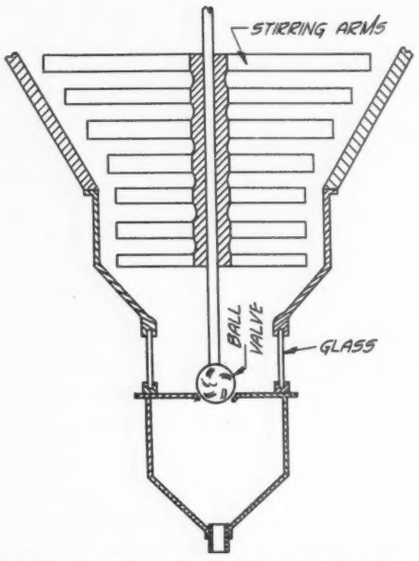


Fig. 69. Classifier with a ball valve which is lifted by a cam on a shaft above

governs it by the amount of the grains which settle out of the sorting column to the discharge.

The Fahrenwald classifier was designed by A. W. Fahrenwald after the study of classification he made at mines in Idaho in connection with the problems of ore dressing. (See U. S. Bureau of Mines Report of Investigations, Ser. 2618, June, 1924.) It is now made by the Dorr Co., of New York City. Fig. 72 is taken from a description of it by W. C. Weber, of the Dorr Co., published in *Industrial and Engineering Chemistry*, June, 1927.

The valve which closes the discharge outlet is on the end of a rod which passes up through a pipe in the center of the sorting column to a rubber diaphragm. The pipe will always contain clear water, as there is no upward current in it to carry sand. This clear water will rise to a level above that of the mixture in the sorting column because of the difference in specific gravity. As more sand is added by the feed to the sorting column, the higher this clear water will rise. This rise will put a pressure on the rubber diaphragm and cause it to lift the rod and valve so that sand will be discharged. As the sand runs out the diaphragm will fall and the valve will partly close until equilibrium is reached. Thus a constant quantity of sand will be maintained in the sorting column producing constant classifying (hindered settling) conditions. As efficiency in classification depends, more than on anything else, on maintaining constant conditions, this is a very efficient classifier.

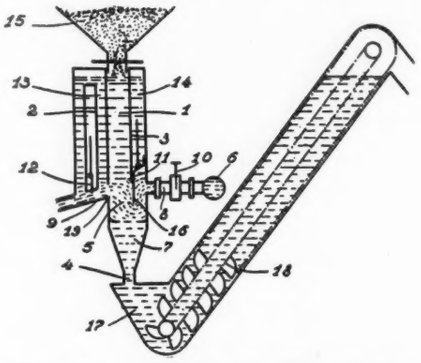


Fig. 70. A Belgian classifier with a screw for elevating the heavy material

A constant flow of water in the rising current is maintained, whether the valve is open or shut, by taking the supply from a tank with an overflow. When water is flowing out with the sand discharge the overflow is lessened proportionately, but the amount going into the sorting columns remains the same.

As shown in Fig. 72, this classifier is usually made in a series, to produce a series of products, which is why it is called a sizer. A series of sized products is especially needed in the ore dressing work for which this machine was designed, and it is of equal importance in some rock products operations, such as the grading of silica sands for certain purposes. The machine could also be used to separate sand from lignite.

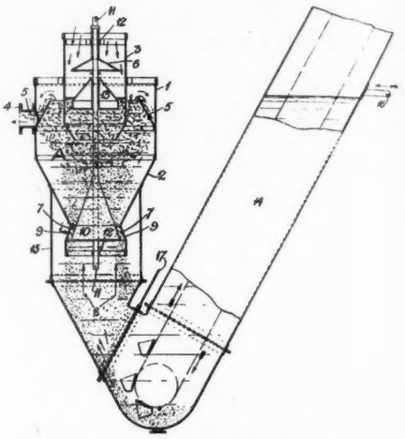


Fig. 71. A British classifier in which the constriction at the bottom of the sorting column is varied by the feed

The Shaw classifier was designed by John Prince, of the Stewart Sand Co., Kansas City, and the writer, as the result of an investigation of methods of separating lignite from sand. As made by the Link-Belt Co., it is shown in Fig. 73. This classifier was recently described in detail in the Machinery Section of Rock Products (October 29 issue), so only the method of control will be described here.

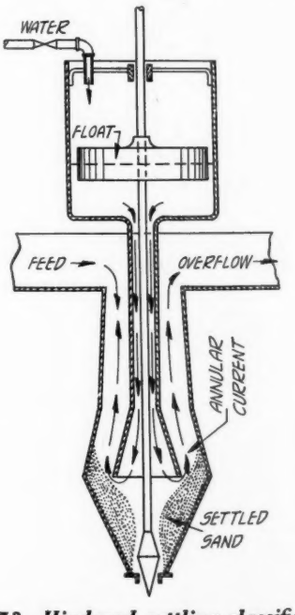


Fig. 73. Hindered settling classifier in which the discharge is controlled by the amount of grains accumulated in the discharge chamber

The discharge is controlled by the amount

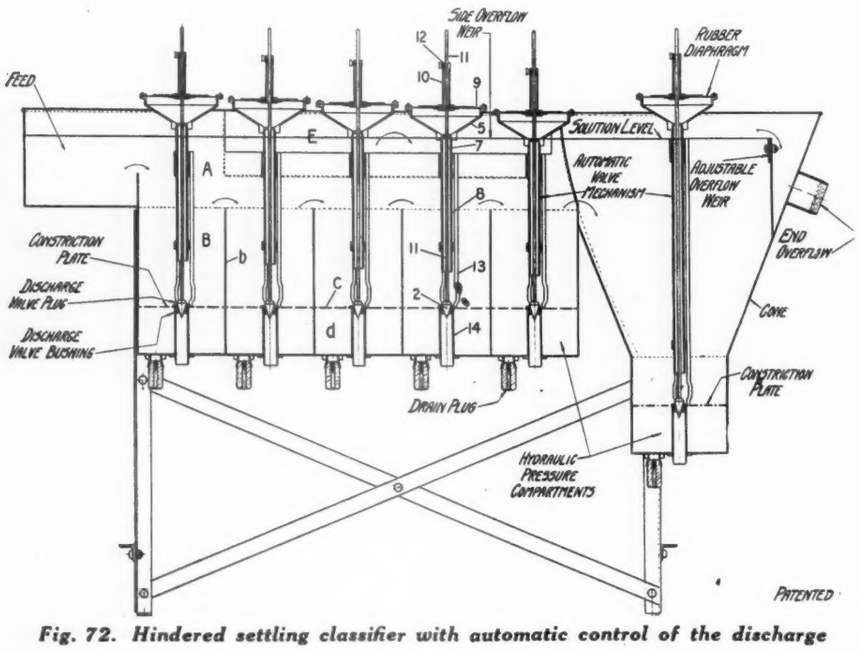
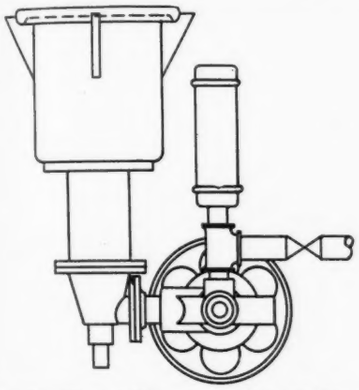


Fig. 72. Hindered settling classifier with automatic control of the discharge

of the grains that pass through an annular current and accumulate in the conical chamber above the discharge valve. (This annular current acts similarly to a constriction in maintaining hindered settling conditions.) When enough sand has accumulated in the conical chamber it obstructs the flow of the water forming this current and causes it to back up in the float chamber above. This raises the float and lifts the valve. The sand



A classifier with a rotating valve to produce pulsating current

flows out until equilibrium is restored, after which the action is continuous.

This method of control was chosen because it was desired to have the sand in the discharge as dry as possible, and the sand discharge does have about the same moisture as the discharge of one of the automatic sand dewaterers described in Part V of this series. In practice it has been found that the sand discharge is about in proportion to the specific gravity of the mixture in the sorting column, so the machine works as a hindered settling classifier. It has been applied to the removal of lignite and also used as a sizing classified. By raising the float chamber high enough, the machine will work as a free settling classifier.

A Classifier with Pulsating Current

The Richards pulsator classifier may be considered as an intermediate machine between a classifier and a jig. It is made in several forms, usually in a series to produce a series of sized products, but the action in all of them is the same. The form shown in Fig. 74 is a single hindered settling classifier with the pulsating current. This is produced by a rotating valve which opens and shuts from 200 to 400 times a minute. An air chamber absorbs the shock, or water hammer effect. The performance records given in Taggert's handbook show it to be an unusually good sizing classifier, but so far as the writer knows it has found no application in the rock products field. It is made by the Denver Engineering Works, Denver, Colo.

The thirteenth and concluding installment of this series will be published in one of the January issues of Rock Products, after which the entire series will be available in booklet form.

Reply to Vibrolithic Complaint Is Filed by Portland Cement Association

Jurisdiction of Federal Trade Commission Challenged, and Competition with Vibrolithic Process Is Denied

THE PORTLAND CEMENT ASSOCIATION has filed a reply to the complaint, which the American Vibrolithic Corp. made through the Federal Trade Commission, charging that the association and its members had employed unfair methods of competition in interstate commerce. (The complaint, with our comments on it, was published in full in Rock Products, August 18, 1928.) In its reply the association asserts that the Federal Trade Commission "is without jurisdiction in the premises, for the reason that there is presented here no instance of competition in interstate commerce, and hence no question of fair or unfair methods."

The Portland Cement Association's answer, in part, follows:

"1. The averments in Paragraph 1 of the complaint are inaccurate, and, because of such inaccuracies, are not correct in fact; for example, the association was organized in 1902 instead of 1916. Nevertheless, respondents agree that the statement in Paragraph 1 contained may be taken as correct in this proceeding.

"2. Respondents admit the averments of Paragraph 2 of the complaint.

"3. Respondents admit the averments of Paragraph 3 of the complaint.

Functions of the Association Explained

"4. Answering Paragraph 4: The respondent association promotes the construction of concrete roads only in the sense that it advocates concrete roads. Neither the association nor the members thereof enter into paving or road making contracts. The manufacturers do compete with each other for the sale of cement to persons having use thereof.

"5. Answering Paragraph 5, respondents aver that the method of construction therein specified is but one of the methods employed under said patented process. They deny that the vibrolithic process is superior or results in a firmer, more durable construction than other methods of concrete road construction. They aver that neither the American Vibrolithic Corp. nor its subsidiaries or sublicensees, sell the machinery in question in interstate commerce.

Variability of Formula

"6. The formulae specified in Paragraph 6 have at various times been advocated in certain instances, but respondents represent that the formula utilized on any given piece of work will vary, depending upon the engineering design of the pavement. Such design is based on many local considerations, including traffic load, foundation conditions, and materials available for construction.

"This is true of recommendations of the respondent association. It is true that upon a given road of like width and thickness, taking the two formulae mentioned in Paragraph 6, there is a difference in the cement required per mile, but that the difference is about 700 bbl. of cement and not several thousands of barrels of cement.

"7. Respondents admit that the respondent Portland Cement Association employs agents and representatives throughout the country whose business it is, among other duties, to encourage and advocate the construction of concrete roads and pavements. Respondents deny that the association prepares and furnishes its agent with printed matter disparaging the merits of the so-called vibrolithic process.

"Respondents aver, however, that from time to time the association has supplied its agents with data relating to extravagant and in some instances false claims and statement of supposed fact made by the Vibrolithic Corp. and its subsidiaries and licensees —and this respondents aver was proper and right.

Jurisdiction Challenged

"8. Respondents deny the averments in Paragraph 8 contained, including sub-paragraphs (a), (b), (c), (d), (e), (f) and (g). The publication understood by respondents to be referred to in sub-paragraph (b) was true in every particular and in no sense constitutes an unfair method of competition in commerce.

"9. Respondents deny the averments in Paragraph 9 of said complaint and aver that the association has no competitors to be prejudiced as averred in said complaint.

"10. Respondents aver that your honorable commission is without jurisdiction in the premises for the reason that there is presented here no instance of competition in interstate commerce, and hence no question of fair or unfair methods. Respondents and the cement manufacturers, members of respondent association, are not in competition in commerce with said vibrolithic organizations or any or either of them and have not been so engaged at any time prior to the issuance of the complaint herein.

"The only commerce involved upon the part of the respondents is that of the manufacture and sale of cement. They sell their products without discrimination to any person, firm or corporation. They do not deal in commerce with paving contracts or road machinery. They nowhere compete in commerce with vibrolithic organizations."

Gypsum and Anhydrite in the Manufacture of Portland Cement

Part II.—A Continuation of the Discussion, Begun in the November 24, 1928, Issue of the Effects on Portland Cement by the Introduction of These Substances

By Richard K. Meade
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FOR the most part, the investigation consisted in grinding to the fineness of commercial cement, clinker selected from a number of different mills to which gypsum and anhydrite in different proportions had been added. Each sample of clinker was mixed with sufficient retarder to make the percentage of sulphur trioxide in the cement 1.75. The mixture was then ground. The following retarders were used

1. Gypsum from Windsor, N. S., alone.
2. A mixture of 75% gypsum and 25% anhydrite from Windsor, N. S.
3. A mixture of 50% gypsum and 50% anhydrite from Windsor, N. S.

In some instances, anhydrite alone was used.

In all cases the clinker as received from the mill was coarsely crushed and the retarder also crushed was added in quantity sufficient to make the SO_3 in the finished product 1.75%.

The grinding was done in a small Abbé jar mill charged with flint pebbles and driven by a motor. About 5 to 7½ lb. of clinker were used for each charge.

The resulting product was tested immediately after grinding for fineness, setting time and tensile strength. A sample was also stored in a paper bag and tested after 14 and 28 days for setting time. This latter was done in order to see if the various retarders were of equal value in preventing a change of setting time in the cement on storage.

The setting time tests were made with both the Gilmore needles and Vicat apparatus. Tensile strength tests were made with one part of cement and three parts standard Ottawa sand. Fineness tests were made with standard sieves and by sand. The soundness test was made by steaming a pat of neat cement for five hours. All tests were made in accordance with the standard methods.

As stated, there are some objections to this practice. In the first place, cement ground to a fineness of 80% through the No. 200 sieve in a small jar mill does not contain as much flour as one to the same degree of fineness in a large mill. This is proved by air analysis and also by the fact that samples of cement ground in a jar mill do not show anything like the same strength that is shown by the same cement ground in the plant to the same tested fineness. For some reason or other, also as previously noted, there seems to be a great tendency to quick-set on the part of cement ground in a laboratory in a small mill. One would naturally expect the opposite, because the jar mill does not grind as much flour as the big mill; but many chemists have frequently observed that samples of clinker brought into the laboratory and ground with a normal percentage of gypsum in a jar mill would set quickly, while the same cement ground in the plant would set normally. This may be due to the fact that the gypsum is not reduced to as fine a flour in the small jar mill as in the large mill, hence is not as active. There are no data to substantiate this contention; it is merely advanced for what it is worth.

Another point which might be brought up is that it would have been better to add the same amount of gypsum in all cases rather than to add gypsum to bring the cement to a constant percentage of SO_3, on the supposition that the SO_3 in the cement clinker is not active. This may or may not be an objection. It depends largely on the condition in which the sulphur is present in the cement. It probably is not all present as trioxide, but when present as sulphur trioxide it is most likely to be there as calcium sulphate and consequently represents an artificial anhydrite.

Clinker for Tests

The clinker was obtained from eight mills. Clinker from these mills was selected because it was believed that it would cover a fairly wide range of chemical composition and method of manufacture.

Mill A—Normal shale-limestone, dry process, located in the south.

Mill B—Normal Lehigh Valley cement rock and local limestone, dry process, located near Nazareth, Penn.

Mill C—High alumina, low silica, clay and limestone, wet process, located in western Pennsylvania.

Mill D—High alumina, low silica, cement rock, dry process, located in Canada.

Mill E—High silica, low alumina, cement rock and limestone, dry process, located in Lehigh district.

Mill F—High silica, low alumina, cement rock and limestone, dry process, located in Lehigh district near Allentown.

Mill G—High silica, low alumina, limestone and clay, wet process, located in eastern New York.

Mill H—Normal Lehigh district cement rock and Annville limestone, dry process, located near Allentown.

All the above plants employed coal for burning.

The analyses of these samples of clinker are given in Table I, the analyses of the anhydrites in Table IV. Also the ratios which control, to a large extent, the setting time and strength of the cement. The *"Silica-Alumina Ratio,"* R_s, is:

$$\frac{\%\ \text{Silica}}{\%\ \text{Alumina}} = R_s$$

The lime-silica, alumina and iron oxide ratio, R_t, is:

$$\frac{\%\ \text{Lime}}{\%\ \text{Silica} + \%\ \text{Alumina} + \%\ \text{Iron oxide}} = R_t$$

This latter ratio I call the *"Lime Ratio."*

Arranging these samples in the order of the silica: alumina ratio we have the follow-

TABLE I. ANALYSES OF CLINKER EMPLOYED IN EXPERIMENTS

Clinker from	Silica	Alumina	Iron oxide	Lime	Magnesia	Sulphur trioxide	Loss on ignition	Ratios R_s	Ratios R_t
Mill A	23.40	6.77	3.55	62.83	1.84	0.28	0.54	3.45	1.86
Mill B	21.86	6.99	3.19	61.95	3.50	0.34	0.60	3.12	1.94
Mill C	20.88	7.12	4.16	63.72	1.60	0.30	0.76	2.94	1.97
Mill D	19.02	6.73	3.81	65.01	3.07	0.48	0.74	2.83	2.20
Mill E	22.22	5.20	2.40	64.32	4.04	0.67	1.06	4.27	2.16
Mill F	22.10	4.99	2.53	64.91	4.10	0.11	0.66	4.52	2.19
Mill G	23.48	5.23	3.85	63.19	2.77	0.25	0.55	4.49	1.94
Mill H	22.82	5.90	2.74	63.13	3.54	0.29	0.56	3.87	2.06

TABLE II. SUMMARY OF TESTS ON GYPSUM AND ANHYDRITE-GYPSUM MIXTURES WITH CEMENT

Clinker from	SO_3 from Gypsum, %	SO_3 from Anhydrite, %	Fineness, passing No. 200 sieve, %	Tested When Freshly Ground: Final Set Gillmore Needle	Final Set Vicat Needle	Initial Set Gillmore Needle	Initial Set Vicat Needle	Tensile Strength 1:3 Sand, lb. 1 day	7 days	28 days	Mixing Water, %	Soundness	Tested after 14 Days Seasoning: Initial Set Gillmore Needle	Initial Set Vicat Needle	Final Set Gillmore Needle	Final Set Vicat Needle	Mixing Water, %	Soundness	Tested after 28 Days Seasoning: Initial Set Gillmore Needle	Initial Set Vicat Needle	Final Set Gillmore Needle	Final Set Vicat Needle	Mixing Water, %	Soundness
Mill A	0	0	85.4	Flash	Flash	Flash	Flash	.....	.....	.....	30	O.K.	Flash	Flash	Flash	Flash	30	O.K.	Flash	Flash	Flash	Flash	30	O.K.
	100	0	93.0	2:30	2:30	4:25	3:30	124	251	337	21	O.K.	2:50	4:10	5:30	4:50	22	O.K.	2:40	2:55	4:20	4:05	24	O.K.
	75	25	90.3	2:25	2:15	4:15	3:30	109	225	341	21	O.K.	2:20	2:50	3:30	4:00	21	O.K.	2:15	2:45	5:00	4:30	23	O.K.
	50	50	90.6	2:20	2:45	4:10	3:15	139	252	290	21	O.K.	3:00	3:25	4:55	4:30	23	O.K.	3:00	2:55	0:35	0:35	22	O.K.
Mill B	0	0	85.7	Flash	Flash	Flash	Flash	.....	.....	.....	35	O.K.	Flash	Flash	Flash	Flash	30	O.K.	Flash	Flash	Flash	Flash	26	O.K.
	100	0	82.8	3:05	3:30	4:45	4:20	79	256	377	22	O.K.	0:40	0:30	5:15	4:45	22	O.K.	0:25	0:30	0:45	0:45	23	O.K.
	75	25	81.8	3:00	3:25	4:45	4:05	80	246	324	22	O.K.	Flash	Flash	0:09	0:09	21	O.K.	Flash	Flash	0:25	0:25	22	O.K.
	50	50	84.3	2:55	3:30	5:15	4:40	74	232	301	23	O.K.	Flash	Flash	0:09	0:09	23	O.K.	Flash	Flash	0:17	0:17	23	O.K.
Mill C	0	0	93.7	Flash	Flash	Flash	Flash	.....	.....	.....	35	O.K.	Flash	Flash	Flash	Flash	26	O.K.	Flash	Flash	0:06	0:06	25	O.K.
	100	0	83.7	2:20	2:50	3:35	3:25	123	263	339	22	O.K.	2:15	2:45	4:00	3:50	22	O.K.	3:25	3:55	5:10	4:40	22	O.K.
	75	25	88.0	2:20	2:35	3:35	3:20	157	286	334	22	O.K.	2:30	2:55	4:15	4:40	23	O.K.	3:25	3:50	5:25	4:50	24	O.K.
	50	50	84.2	2:55	2:55	4:25	3:35	67	236	325	22	O.K.	3:25	3:35	5:20	5:20	22	O.K.	2:50	3:50	5:25	4:50	23	O.K.
Mill D	0	0	93.7	Flash	Flash	Flash	Flash	.....	.....	.....	35	Uns'd	Flash	Flash	0:08	0:08	28	Poor	Flash	Flash	0:14	0:14	27	O.K.
	100	0	84.5	2:50	3:00	4:25	3:50	95	196	213	22	Uns'd	4:10	4:10	5:25	4:55	24	O.K.	1:40	2:40	5:25	4:40	24	O.K.
	75	25	80.1	2:40	3:00	4:40	3:55	64	141	186	22	Uns'd	3:05	3:45	5:00	4:45	23	O.K.	1:35	2:35	4:50	4:50	23	O.K.
	50	50	82.5	3:10	3:35	4:50	4:25	48	156	195	21	Uns'd	1:35	2:50	3:50	3:35	23	O.K.	1:50	2:05	3:50	3:05	23	O.K.
Mill E	0	0	92.12	Flash	Flash	Flash	Flash	.....	.....	.....	30	Uns'd	0:05	0:25	0:25	0:40	27	Poor	Flash	Flash	0:16	0:16	26	Poor
	100	0	83.6	3:25	3:25	5:25	4:40	50	150	219	23	Uns'd	3:25	3:55	5:20	4:55	23	Poor	2:20	2:35	3:35	3:20	22	Poor
	75	25	82.2	3:45	3:30	5:15	4:30	49	122	203	23	Uns'd	.....	.....	.....	.....	.....	.....	2:20	2:35	3:05	3:05	24	O.K.
	50	50	80.6	3:25	3:40	4:55	4:10	61	137	201	22	Uns'd	3:25	3:55	5:50	5:35	23	O.K.	2:05	2:20	4:05	3:35	26	O.K.

ing order:

Mill F	4.52	Mill A	3.45
Mill G	4.49	Mill B	3.12
Mill E	4.27	Mill C	2.94
Mill H	3.87	Mill D	2.83

Arranged in order of the lime radio we have the following order:

Mill D	2.20	Mill C	1.97
Mill F	2.19	Mill B	1.94
Mill E	2.16	Mill G	1.94
Mill H	2.06	Mill A	1.86

A cement with a low silica: alumina ratio, other things being equal, is much more apt to be quick-setting, or to become so on seasoning, than one with a high silica:alumina ratio. Also a cement with a low lime ratio, other conditions being the same, is more apt to be quick-setting, or to become so on seasoning, than one having this ratio high. Bearing this in mind, therefore, it will be noted that Mills A, B and C occupy positions near the low end of each list, while Mill D, which has the lowest silica: alumina ratio has the highest lime ratio. Mills E, F and H have high ratios in both lists. We would, therefore, expect Mills A, B and C to show most trouble with setting time, Mills A, B and C to show most trouble with setting time, Mills E, F and H least and Mill D, had the cement been sound, owing to its high lime ratio, to show very little trouble in spite of its low silica: alumina ratio. In the case of this clinker, however, owing to its unsoundness, one would expect it to have a slow set when freshly ground, but possibly to become quick-setting on seasoning. It will be noted that this expectation is to some extent borne out by the tests.

The writer is inclined to believe that in the case of both the clinker from Mill E and Mill D the grinding of the raw materials was not fine enough to permit of such a high lime ratio. This is indicated by the soundness test, which is unsatisfactory in both these cases, showing free (uncombined) lime to be present, while in the case of the clinker from Mill A the lime ratio seems to be too low. One would expect much better setting time behavior in the case of this clinker if this ratio had been 2.0 or higher.

Action of the Retarders—Setting Time

The effect of the various retarders on the setting time of the clinker is shown in Table II and in the graphs which follow, Figs. 1 to 7, inclusive.

It should also be remembered that the setting time test is not a very accurate one, and that the manipulation of the test piece, the temperature of the air, and the difficulty of observing accurately the point at which the needles do not penetrate the pat, all make actual measurement of setting time inexact. A difference of 10% in the setting time

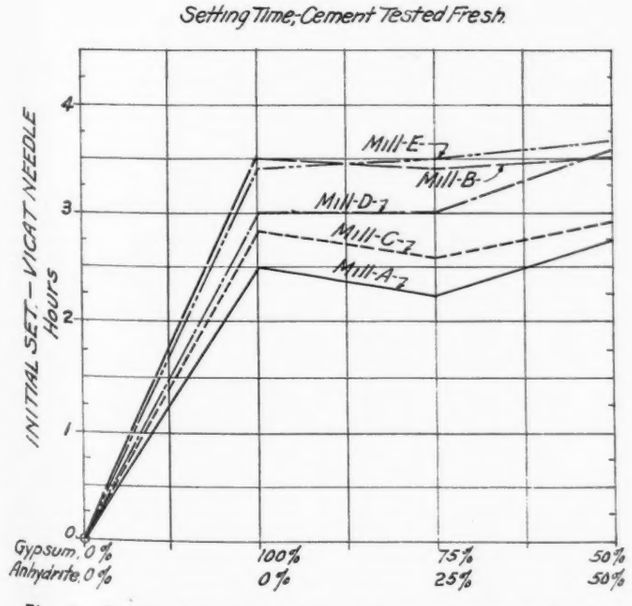


Fig. 1. Graph showing results of tests at five portland cement mills on the setting time of cement tested fresh

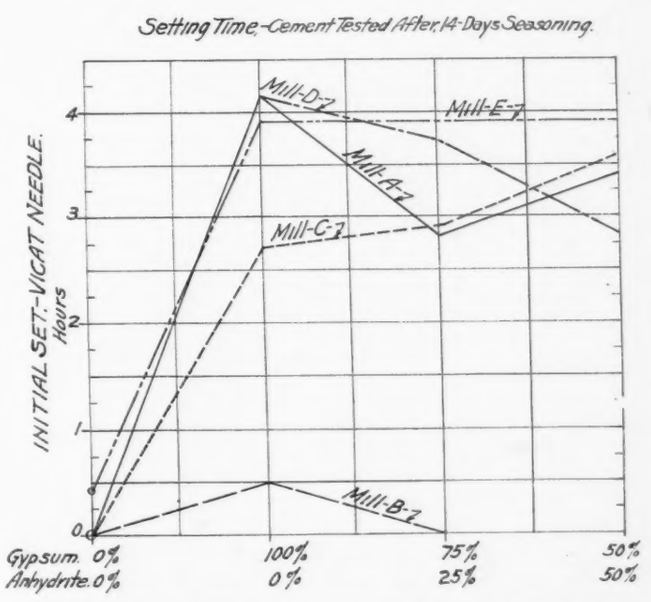


Fig. 2. The setting time of cement tested after 14 days seasoning, showing the results at five different mills

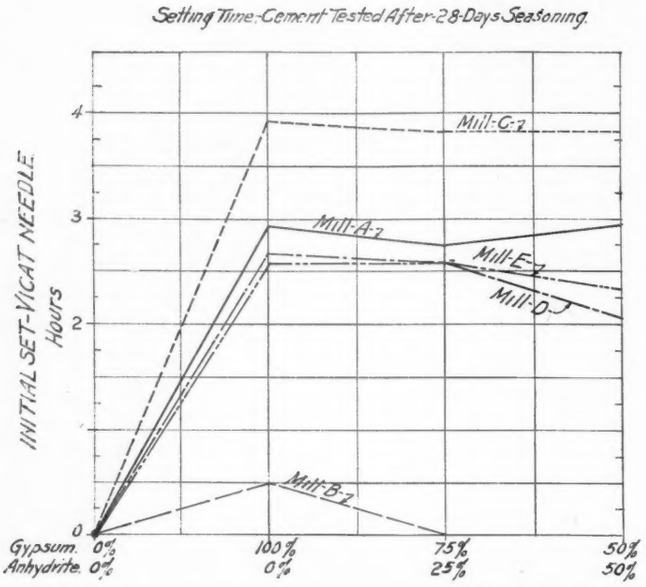


Fig. 3. The setting time of cement tested after 28 days seasoning, showing the results at five different mills

might easily be made in a retest of the same sample by the same operator under what he believes to be the same conditions. Setting times of, say, 3 hr. and 20 min. and 3 hr. should be considered as practically identical. The author found the setting time of all the samples of clinker to which no retarder was added as being practically instantaneous, or a "flash set."

The first series of tests was made upon the clinkers from Mills A, B, C, D and E. The result of this test is given in Table II. It will be noted by referring to Table II, or more conveniently Fig. 1,* that when the cement is tested, freshly ground, the gypsum anhydrite mixtures appear to be practically as effective as gypsum in all cases. Tests made with both the Gillmore needle and the Vicat apparatus are substantially in agreement as to this.

The cement used for the above test was then set aside in a paper bag, on a shelf, in the laboratory, and tested after 14 and 28 days. When tested after 14 days' seasoning in a paper bag (refer to Fig. 2), the cements all show "flash set" without retarders. The action of the retarders is less uniform after seasoning. Of the five clinkers comprising this test, it will be noted that with clinker from Mill C, the mixture of 50% anhydrite and 50% gypsum was apparently more effective than gypsum only, with clinker from Mills A and E, the results are practically the same, as when tested fresh, while on the other hand the clinker from Mills B and D are apparently less retarded by the anhydrite mixtures than by gypsum alone. The clinkers from these latter two mills as pointed out are somewhat abnormal and likely to give trouble. It will be noted, however, that the cement from Mill B is quick-setting even with the pure gypsum, while that from Mill D, although somewhat quicker with the anhydrite-gypsum mixture than with pure gypsum, still has a *very satisfactory* setting time.

The clinker from Mill B had both a low silica:alumina ratio and also a low lime ratio. The clinker from Mill D was unsound when fresh, but when seasoned 14 days had become sound. The writer is inclined to believe that the apparent less effectiveness of the anhydrite mixture in the case of these two clinkers, as is the apparent more effectiveness of anhydrite in the case of Mills A and C, is purely a variation in the test. Of the two clinkers which gave a quicker setting time with the 50% anhydrite-50% gypsum mixture, it will be noted (see Fig. 3), that after seasoning for an additional 14 days (28 days in all), the cement from Mill B was still quick-setting with the pure gypsum; while in the case of that from Mill D, the 50% anhydrite 50% gypsum mixture was about as effective as the gypsum. In this case it will be noted that the Gillmore needle and the Vicat needle differ somewhat in their relative findings. The former shows the anhydrite mixture to be slightly more effective as a retarder, the Vicat needle favors the gypsum—no doubt again just a vagary of the test.

When tested after 28 days seasoning (see Fig. 3), it will be noted that the setting time of the cements with gypsum and with the gypsum-anhydrite mixtures act more nearly alike. What variations do occur may easily be accounted for by differences of manipulation, temperature, etc. The effectiveness of gypsum alone and mixtures of gypsum and anhydrite, therefore, may be considered to be about the same after seasoning for 28 days.

The reason for the change in the setting time of cement upon seasoning has never

*The figures or graphs give the setting time according to the Vicat Needle.

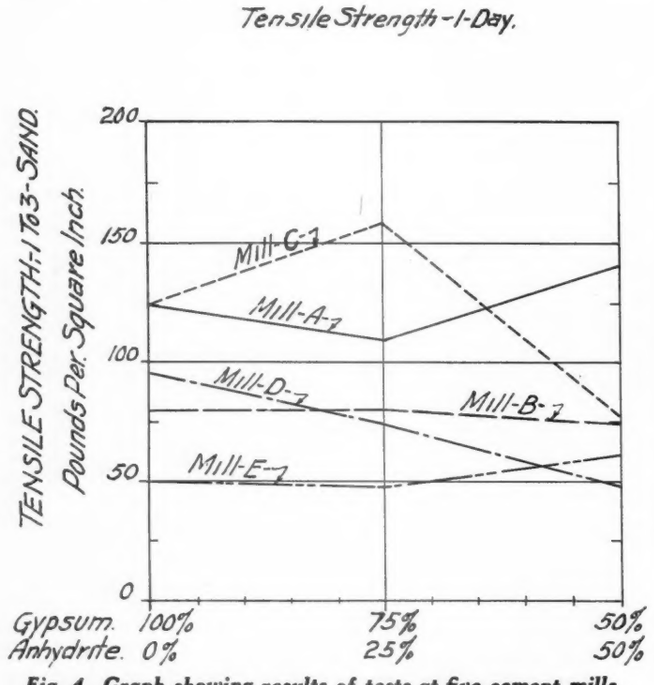


Fig. 4. Graph showing results of tests at five cement mills to determine the tensile strength of cement after one day

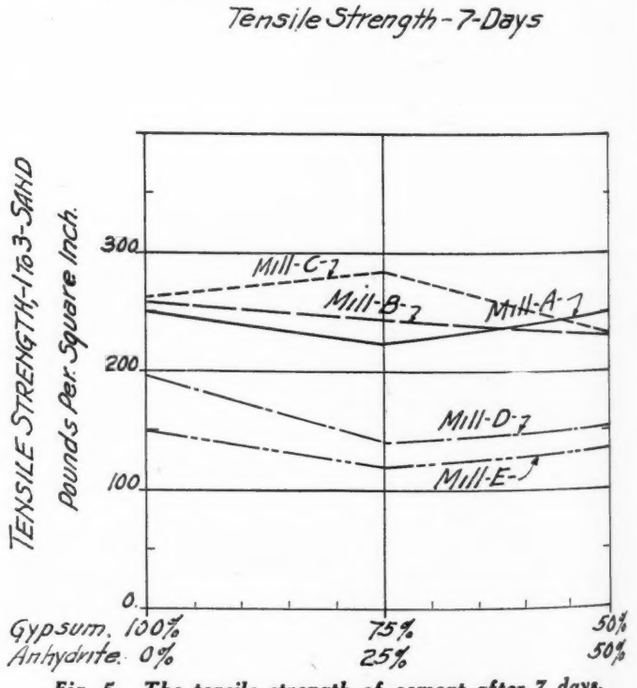


Fig. 5. The tensile strength of cement after 7 days, showing the results at five different mills

been satisfactorily explained. Often in actual practice where *pure gypsum* has been used as a retarder the cement becomes quick-setting on seasoning. There is a slight tendency, particularly in the case of unsound cements, for some disintegration of the clinker to take place, causing a slightly larger quantity of fine material to be produced. In most cases, however, the quantity of such material produced is insufficient to account for the fact that the cement becomes quicker setting on seasoning. It is much more probable that this quickening of the set is due to hydration of some compound in the clinker. So far as the writer has been able to observe, this change never takes place in cement seasoned in an air and moisture-proof container. It is generally more likely to occur in cements with a low lime ratio than in those with a high lime ratio, and this probably accounts for the fact that the most marked change occurs in the setting time of the clinker from Mill B after seasoning for 14 and 28 day periods.

In considering the tests, I think that it should be borne in mind that the clinker from Mill B shows some signs of being abnormal. As stated, the lime ratio is rather low for satisfactory results in the Lehigh district, and it will be noted that *none* of the cement made from this clinker, even where pure gypsum has been used as a retarder, has a setting time which passes the standard specifications after seasoning 14 days. Even the sample with the pure gypsum has an initial set of 25 minutes by the Gillmore needle and 30 minutes by the Vicat needle, the standard requirements being 60 and 45 minutes, respectively. It may also be stated positively that this clinker does not represent the normal composition of the cement at this mill, where a lime ratio of about 2 to 2.1 is carried in regular practice.

In the case of all mills except Mill B, the setting time of the cement retarded with even the 50% gypsum 50% anhydrite mixture is perfectly satisfactory, both freshly ground and after 28 days seasoning, and the slight quickening of set which has taken place may be considered as an advantage rather than a disadvantage. An initial set of from 2 to 3 hours would certainly represent very satisfactory material. In the case of Mill B the cement fails to pass the standard specifications for setting time (45 minutes) whether pure gypsum or gypsum-anhydrite mixtures were used as retarders.

In all cases in mill practice, where cement retarded with gypsum containing anhydrite has become quick-setting on seasoning, the writer believes this is due to a low lime ratio, possibly made necessary by coarse grinding of the raw materials, and that the setting time of such cements is very likely to vary on seasoning, no matter what retarder is used.

Much in Favor of High Lime Ratio

There is much in favor of carrying a high lime ratio and the writer feels inclined to suggest to all manufacturers that they increase the lime ratio where it is below 2. The advantages are:

1. A very regular and uniform setting time regardless of whether pure gypsum or mixtures of gypsum and anhydrite are used, and particularly *when tested after seasoning.*
2. There is less liability for the cement in which the lime ratio is fairly high to become irregular as regards its physical properties when stored.
3. The high lime ratio will give greater strength at short periods, which is desirable in modern construction.
4. High lime clinker is easier ground than low lime clinker. Greater outputs can be obtained from the mill or greater fineness at the same output. This means less power for grinding and less repairs.

The objection to a high lime ratio is generally the difficulty experienced in obtaining a cement which will pass the soundness test, if the lime ratio becomes too high. This objection can be overcome by proper methods of mixing the raw materials, if the dry process is used, and finer grinding of the raw materials.

In the wet process, good control of the chemical composition should always be obtained; and a fairly high ratio can be carried without danger of exceeding the safe limit, provided the raw materials are ground fine enough. Where the dry process is employed and difficulty is experienced in controlling the mix, a proper system of blending the ground mix (raw material) should be installed.

Effect on Strength

These tests indicate clearly that with a small laboratory mill we do not obtain the tensile strength which might be expected at the fineness to which the cement is ground. In grinding in a small jar mill, the pressure exerted is not as great as that in a large mill, and experience has shown that the greater the pressure exerted in grinding the more *impalpable powder* will be produced. For this reason the jar mill will not give as much extremely fine cement as will the large tube mills now employed, even though the sieve test may be identical.

This applies to *all* samples ground. We may, therefore, consider that the tensile strength of cement ground in large mills

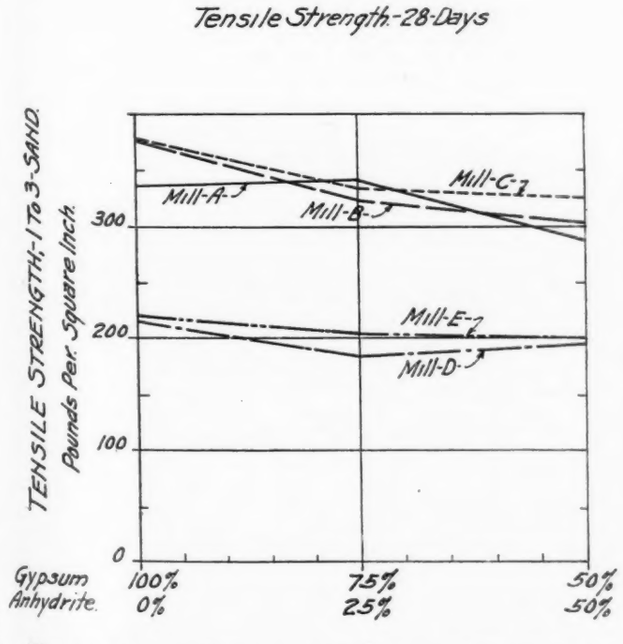


Fig. 6. *The tensile strength of cement after 28 days, showing the results at five different mills*

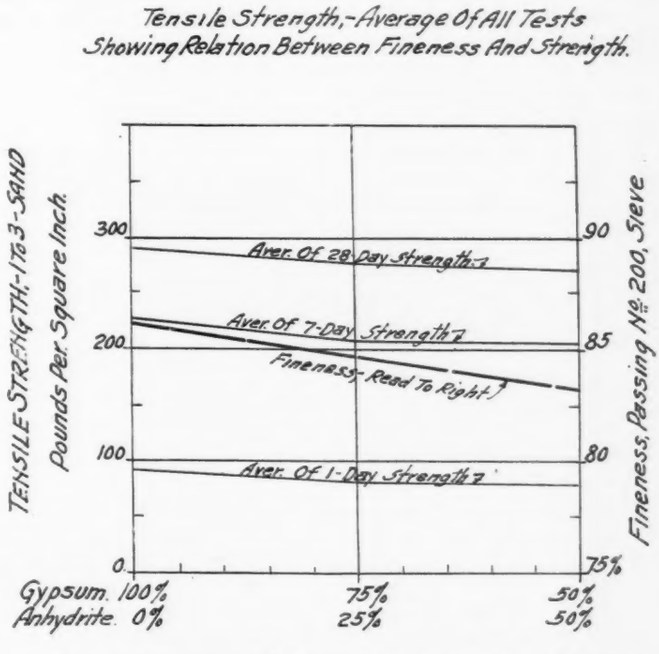


Fig. 7. *The average of all tensile-strength tests of five different cements showing the relation of fineness to strength*

TABLE III. TEST OF CEMENT IN WHICH PURE ANHYDRITE WAS USED

Clinker from Mill	Retarder	Fineness passing No. 200 Sieve, %	Tested When Freshly Ground: Initial Set Gillmore Needle	Initial Set Vicat Needle	Final Set Gillmore Needle	Final Set Vicat Needle	Tensile Strength 1:3 Sand, lb./sq.in. 1 day	7 days	28 days	Mixing Water, %	Soundness	Tested after 14 Days Seasoning: Initial Set Gillmore Needle	Initial Set Vicat Needle	Final Set Gillmore Needle	Final Set Vicat Needle	Mixing Water, %	Tested after 28 Days Seasoning: Initial Set Gillmore Needle	Initial Set Vicat Needle	Final Set Gillmore Needle	Final Set Vicat Needle	Mixing Water, %	Soundness
F	Anhydrite from Nova Scotia....	83.3	2:55	2:55	4:25	4:10	50	198	292	20	Uns'd	3:45	4:00	5:30	5:15	22	3:10	3:40	5:55	5:40	21	O.K.
G	Gypsum from Windsor, N. S...	86.2	3:40	3:55	5:25	5:10	60	215	395	20	O.K.	4:30	4:55	6:00	5:45	20	4:15	5:00	6:30	6:00	21	O.K.
G	Anhydrite from Nova Scotia....	81.5	4:05	4:15	5:35	5:20	60	195	315	21	O.K.	3:35	4:05	6:05	5:50	22	3:20	3:50	6:05	6:05	22	O.K.
G	Anhydrite from Midland, Calif.	82.7	3:20	3:50	4:35	4:50	30	210	280	20	O.K.	3:55	4:25	5:40	5:25	20	3:10	3:40	5:00	4:35	20	O.K.
G	Anhydrite fr'm Southard, Okla.	82.6	4:05	4:35	6:10	5:50	37	215	308	21	O.K.	4:10	4:40	6:10	5:55	20	3:20	3:50	5:20	5:05	20	O.K.
H	Anhydrite from Nova Scotia....	85.5	3:10	3:20	4:25	4:25	80	255	345	21	O.K.	4:30	4:30	6:15	5:45	22	3:00	3:00	5:30	5:15	21	O.K.

would be *considerably* higher than that shown by these tests, and the tests which were made in the small mill must, therefore, be considered as *relative* rather than exact. The writer believes, however, that the relations hold and that in a general way the result of these tests can be taken as pointing to certain definite conclusions.

It should also be remembered that where a cement sets too quickly to be worked into briquets, that low results will be obtained in the tensile strength tests, because during the process of making the latter the setting is going on and consequently the manipulation of the mortar disturbs the proper bonding action and prevents the development of full strength.

The effect of gypsum and of mixtures of anhydrite and gypsum on strength is shown in Figs. 4, 5, 6 and 7. By referring to these graphs, it will be noted that so far as the strength tests go, there seems to be very little difference between the action of anhydrite and of gypsum. In the case of the clinker from Mills A, B, D, and E, the difference between pure gypsum and mixture of this and anhydrite is practically within the limits of what might be expected, due to the difference in fineness of the various samples. In some cases, better results were obtained with the anhydrite than with pure gypsum in spite of the fact that the sample ground with the pure gypsum is often finer than the sample ground with the anhydrite mixtures. The difference in no case, however, appears to be so marked that we can say that anhydrite has any more influence on the strength of the cement than gypsum and *vise versa*.

In the case of Mill C, the 50% anhydrite mixture does not give the same strength as pure gypsum. The falling off seems to be greatest at the one-day period. This in spite of the fact that the fineness of the two samples are quite similar and that anhydrite behaved as a retarder of set equally effectively as the gypsum. The contrary result in this instance is probably merely due to conditions of fineness, etc., not shown by the test; or possibly to conditions during the making up of the series of briquets. It will be noted that the results with 25% anhydrite are better than with pure gypsum in the case of this clinker, which would hardly be likely if anhydrite had any adverse influence on strength.

In the graph, Fig. 7, the strength and also the fineness of all samples have been averaged. From this it will be seen that the average of strength of all the cement retarded with the anhydrite-gypsum mixtures is a little lower than that retarded with pure gypsum, but also that the fineness of the latter is a little greater, which fully accounts for the slightly greater strength of the latter.

The test certainly would indicate with sufficient finality that so far as the strength goes the action of gypsum and anhydrite are practically identical and that mixtures of the two may be used without in any way affecting the strength of the cement.

Soundness

All of the clinker samples received except those from the Mills D and E were entirely sound even with the addition of retarders. In the case of both of these clinkers, the addition of neither the anhydrite mixtures nor the pure gypsum had any effect on the soundness when the cement was tested fresh. It may be noted, but it is probably an accident, that in the case of Mill E the cement retarded with half gypsum and half anhydrite has seasoned sound at the end of 14 days, while the cement containing pure gypsum had not and that at the end of 28 days the cement retarded with pure gypsum was still unsound, while those retarded with the anhydrite-gypsum mixture were all sound. It is probable that this is merely a chance, and that the action of both forms of sulphate on soundness is practically the same. At any rate, this one instance would hardly justify saying that anhydrite was of more value in correcting unsoundness than gypsum.

Anhydrite Alone

In the second series of tests, the clinker was ground with anhydrite alone. In all instances, the clinker was first crushed and sufficient anhydrite was added to bring the sulphur trioxide in the resulting cement to 1.75%. In this case, the anhydrite itself was very finely ground so that there could be no possible doubt about its being in a fine condition. At first, attempts were made to grind the anhydrite wet and separate the finer portion by suspension in water. As noted previously, this failed because the mineral hydrated and set. The anhydrite was, therefore, ground dry for eight hours in the small jar mill. It then all passed the No. 200 sieve. With the further grinding which the retarder received when ground with the clinker it should all have been reduced to an impalpable powder.

The clinkers selected for the test were those from Mills F, G and H, and the results of the test are given in Table III.

In the previous experiments the anhydrite used was selected from Nova Scotia mines. In this series of tests anhydrites from Nova Scotia, Midland, Calif., and Southard, Okla., were used with the clinker from Mill G. The analyses of these anhydrites are given in Table IV.

It will be noted, (1) that in all instances the anhydrite was effective in slowing the set of the clinker, and (2) that anhydrite from all these localities had about equal effect.

It will also be noted that in the cases of all three clinkers the cement retarded with anhydrite remained slow setting. Variations in setting time, as stated, are quite usual when the same sample is tested at different times. It is hard to say whether this is due to the different conditions under which the test is made, such as temperature and humidity of the air at the time of test, manipulation of the test, etc., or whether the cement itself has changed. This is particularly true when the setting time changes within the range of from two to three hours initial and four to six hours final. In this series of tests it will be noted that the same cement tested at various periods of seasoning does not have the same setting time, and this is true whether the cement is retarded with gypsum or anhyrite.

It will also be noted that the cements made from the same clinker, but retarded with the anhydrites from the three localities, do not have identical setting times, and this difference is not explainable by the fineness of the three samples, but may be explainable by variations in manipulation, humidity and temperature when the test was conducted. On seasoning, also, these three do not behave identically. The writer is inclined to believe, however, that the three anhydrites act similarly and any variations in results are due to variations in manipulation or to differences in fineness not revealed by the sieve test. Possibly, too, the seasoning in each instance may not have been under identically the same conditions, since the samples were not all ground on the same day.

The sample of clinker from Mill D previously referred to was also tried with the

TABLE IV. ANALYSES OF GYPSUM AND ANHYDRITE USED IN THE EXPERIMENTS

	Gypsum from Windsor, N. S.	Anhydrite from Windsor, N. S.	Anhydrite from Southard, Okla.	Anhydrite from Midland, Calif.
Chemical Analysis				
Water	20.29	1.79	1.20	0.81
Sulphur trioxide	45.60	57.00	57.20	57.20
Silica and insoluble	0.62	0.58	0.44	0.55
Iron oxide and alumina	0.42	0.38	0.16	0.25
Lime	33.28	40.78	43.38	40.72
Magnesia	.....	.....	.....	.....
Mineral Analysis				
Gypsum	96.99	8.55	5.73	3.87
Anhydrite	2.18	91.02	93.05	94.86
Sflica and insoluble	0.62	0.58	0.44	0.55
Iron oxide and alumina	0.42	0.38	0.16	0.25
Specific gravity	2.32	2.82	2.90	2.88

three samples of anhydrite. In each instance the anhydrite retarded the sample when freshly ground, but as in the case of gypsum the sample of cement on exposure became much quicker setting. Attention has previously been called to the abnormal behavior of this clinker both as regards erratic setting time and unsoundness. The anhydrites from Southard, Okla., and Midland, Calif., behaved with this sample quite similarly to that from Nova Scotia.

It seems quite clear from these latter experiments that anhydrite alone, if finely ground, will slow the set of cement and that, generally speaking, anhydrite from various localities has the same effect.

So far as the strength goes it will be noted that pure anhydrite gives strengths which compare favorably with strengths obtained when gypsum is used, and that there appears to be no difference between the various anhydrites as regards this property of cement. It is true that the cement ground with gypsum gave the higher strength, but this sample was ground much finer, which easily explains this.

Low Grade Gypsum

In all of the experiments detailed, high grade gypsum containing 45.6% sulphur trioxide was used. Some cement chemists state that they prefer low grade gypsum. When this preference is based on the fact that inefficient equipment employed for proportioning the gypsum and clinker will handle a large quantity of the former better than a small quantity of the latter, the preference may have some foundation, but if based on any inherent properties of the low grade gypsum itself, the preference would seem to be unjustified by either theory or economy. Low grade gypsum can seldom be purchased per unit of sulphur trioxide at a lower cost than high grade rock.

So far as is known, no one has ever claimed that calcium carbonate or clay would slow the setting time of cement, and all chemists seem agreed that it is the calcium sulphate which is active. If this is the case, this is the material to buy. If calcium carbonate or clay are considered necessary to retard the setting time, it would appear that these are present at all cement plants and need not be purchased.

There is another point in this connection worthy of note, namely, that the low grade gypsums are quite variable in composition, and this irregularity might easily lead, under ordinary mill conditions, to too little sulphur trioxide in the cement for proper retardation when a lot of gypsum low in sulphur trioxide is received at the mill; or cement with too much to pass the specifiations when a lot high in sulphur trioxide arrives, etc.

The argument that low grade gypsum costs less than the present selling price of cement and hence can be used with impunity, so far as expense goes, is not only admitting a desire to adulterate the cement, but is probably a fallacy—the gypsum loses 20% on grinding, it must be handled and ground and hence represents when converted into cement probably as great an expense as clinker. Again if adulteration is the aim, why not use raw material? The writer feels sure that the American cement manufacturer desires only to make the best cement he can and certainly would not for a moment countenance such a practice as this direct adulteration.

Conclusions

Taking into consideration the results of the experimental work described, all of the accumulated plant experience with anhydrite-gypsum mixtures, all theoretical matters and all other pertinent data the author has come to the following general conclusions:

1. Anhydrite-gypsum mixtures of present commercial or any probable future commercial anhydrite content are effective and safe retarders for portland cement.
2. The SO_3 content of the anhydrite in such mixtures is as effective as the SO_3 content of the gypsum.
3. The effect of these mixtures on retardation is just as good as of pure gypsum, per unit of SO_3 added.
4. The effect of these mixtures on the strength of the cement is no greater or no less than of pure cement, per unit of SO_3 added.
5. Pure anhydrite is in itself a retarder for cement, even under laboratory conditions.
6. Anhydrite is decidedly not an injurious impurity, nor is it an inert adulteration in gypsum for cement retardation.
7. So far as can be told from the tests made, anhydrites from different localities behave the same when used as cement retarders.

Canada, Too, Enjoying a Construction Boom

THE LARGEST DISTRIBUTIVE trade in the history of Canada and the greatest volume of construction on record are reported by S. H. Logan, general manager of the Canadian Bank of Commerce, in his survey for November based on reports from the bank's branches. Mr. Logan says:

"The volume of construction in Canada as measured by contracts awarded during the last 10 months is the greatest on record, which in effect means that the public has invested in capital improvements of a permanent character more of its savings than ever before, that it has raised its standards of living, health, recreation and education, and has contributed in a most substantial manner to the prosperity of the country as a whole by providing new business to producers of building materials, manufacturers, railways, etc., and employment to practically every man fitted for and desirous of work.

"The peak of this year's great program has been reached, as construction is a seasonal industry. A fundamental change has, however, taken place in the construction industry in recent years, for the building season has been lengthened by continuing work, particularly that which can be performed indoors, in the fall and winter months.

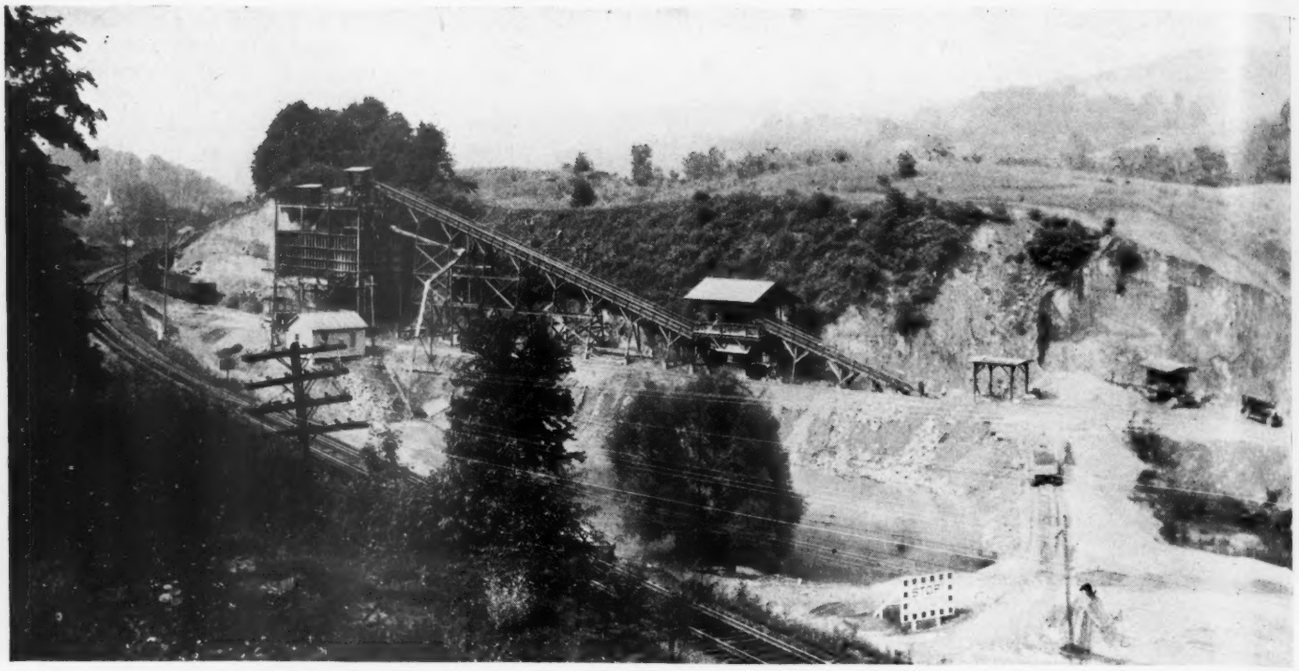
"According to the bank's estimate, work to the value of $150,000,000 in connection with contracts awarded since January is still to be completed, and an exceptionally large volume of new construction is planned for, so the amount to be expended on the winter-spring program will probably exceed that for any previous corresponding period."

Mr. Logan also cites practically full-time employment and a greater movement of Canadian wheat, both to domestic storage points and to foreign markets, than in the autumn of 1927 as factors which indicate a continuation of Canada's rapid development.

Cloth Cement Bags

INCREASED DEMAND for cotton containers for the shipment of cement has been noted in recent months, according to reports received from manufacturers by the New Uses Section of the Cotton-Textile Institute, Inc., in a study of this use of cotton which has just been completed. Ernest C. Morse in charge of this section states:

"For a number of years cloth bags have been used as containers for cement in far greater proportion than any other material. It is estimated that about 250,000,000 cloth sacks are used annually in making shipments of cement in this manner. For replacements approximately 60,000,000 bags—equivalent to 60,000,000 sq. yd.—are required each year."



The Alfred-Atlas plant seen from one of the picturesque hills which surround the new operation

A New Gravel Plant in the South-Western Part of New York State

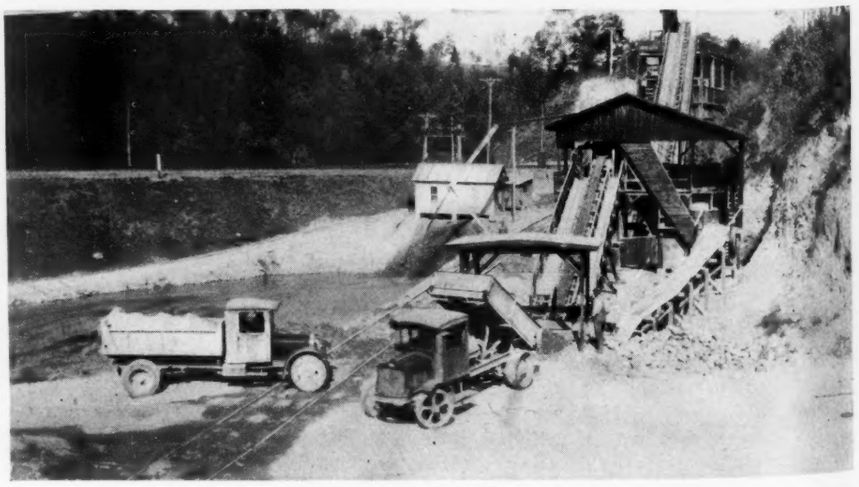
Alfred-Atlas Sand and Gravel Corp., at Alfred, N. Y., Completes First Season with a Fine Record

AT the present time there are few places where the supply of gravel is abundant, and the market is present, and yet where there are no operations going forward to market the material. However, such a situation was present at Alfred, N. Y., when the Alfred-Atlas Gravel and Sand Corp., built its new plant there, taking over gravel property which had been worked for a number of years as a small bank-run operation. This company was formed only recently to work this deposit, but already has become well known in its territory in southwestern New York state.

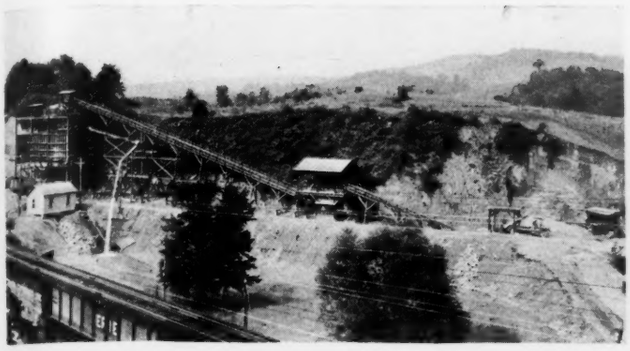
The company owns five gravel pits on property totalling about 180 acres in extent. More properly, these are hills of gravel, every one higher than the plant itself, and the one which is now being worked to the greatest extent is approximately 300 ft. higher than the road to the plant. Four pits are on one large tract, about three-quarters of a mile from the plant, and connected to the plant by a state concrete highway, while the fifth pit is right at the plant. Trucks are used to bring the material from the distant pits.

The company contracts all of its trucking, as it is felt that this permits more flexibility of use, and does not entail a high carrying charge when the plant is idle or not running at capacity. Also the character of the hauling, over very steep and extremely rough roads for the most part, is such that the company executives feel that maintenance on the trucks would be excessive.

The plant itself is a logically designed and well-layed-out piece of work. It was particularly designed to turn out material to meet the New York state highway specifications, as in an area where there are not many large towns, a large part of the market is found in road work. Also the plant is not large, having a capacity of about 600 cu. yd.



Trucks from the five pits of the company dumping to the receiving hopper at the foot of the first belt conveyor



View of the plant showing washing plant at the left, the crusher enclosure, and the receiving hopper at the right

The building containing the scalping screen and the crusher, with the washing plant and bins at the rear

daily. However, this has been increased during the past season by working longer hours, sometimes the plant operating from 5 a. m. until 12 p. m. During the summer as high as 22 carloads have been shipped out in one day, and this material all passed through the plant at the time, as the company has no stock pile at present. Shipping is mostly by rail, although some truck shipping is done over the concrete road which passes the plant.

Plant Design

Material is brought by truck and dumped to a bar grizzly over a Telsmith 20-in. by 5-ft. plate feeder in a concrete pit. This feeder delivers the material to a 20-in. belt conveyor of 85-ft. centers, which takes it to the scalping screen. This is a 32-in. by 12-ft. Telsmith revolving screen with two sets of interchangeable screening sections, one set having 1½-in. perforations and the other having 2¾-in. perforations. These sets are used alternately, depending upon market requirements and the nature of the deposit fed to the plant. Thus, it is possible quickly to adapt the layout to produce a large percentage of either small or large gravel. The scalping screen is driven by a 50-hp. 220-volt, Crocker-Wheeler motor, which also drives the belt conveyor from the bar grizzly. The feeder under the grizzly is driven from the foot shaft of the conveyor.

The Smith Engineering Works of Milwaukee, Wis., were the designers of this plant, and Telsmith equipment is used throughout. Crocker-Wheeler slip-ring induction motors are also used exclusively.

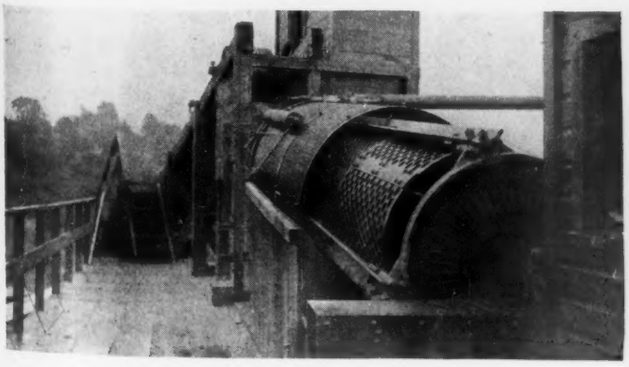
Below the scalping screen is an 8-A primary crusher to which the rejects drop. The discharge of this crusher goes to the boot of a belt elevator of 28-ft. centers, which returns it to the scalping screen above. Both the crusher and the elevator are driven by the same 50-hp. motor which drives the scalping screen.

The receiving hopper, feeder and conveyor to the scalping screen

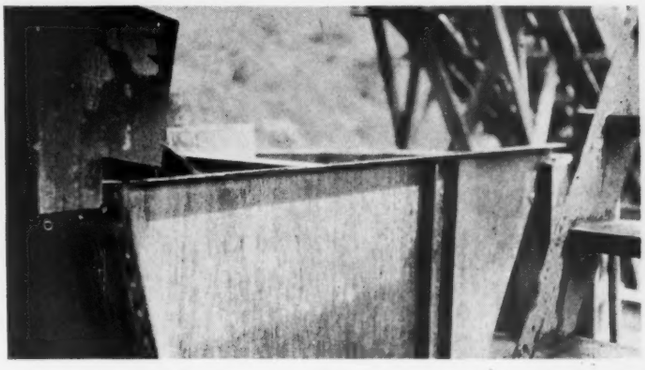
The larger stones which the bar grizzly at the receiving hopper separates from the finer pit material are broken up by hand and the pieces dumped directly to the crusher. A runway has been built from the hopper up to the crusher, and the stone is carried up this in wheelbarrows. The work of breaking the larger rocks is done by the men on duty at the hopper in their off time, and hence does not require an additional outlay for extra help. As the crusher will easily take care of all but about 5% of this stone, without hand breaking, it is obvious that this method of utilizing all of the material is the most economical all around.

The material passing through the scalping screen drops on a 20-in. belt conveyor of 178-ft. centers, which elevates it to the top of the washing plant and delivers it to a main sizing screen. A 15-hp. motor drives this belt. The screen is a heavy duty Telsmith Ajax washing screen, 40 in. in diameter by 16 ft. 6 in. long and is fitted with a jacket. It is also driven by a 15-hp. motor. This screen is fitted with a roller on hinged arms which rolls over the surface of the jacket, thus aiding in keeping the perforations in the screen clear.

No. 3A stone as designated by the New



The jacket sizing screen with a roller attachment for keeping the screen perforations clear



The sand settling box below the sizing screen for reclaiming concrete sand

The receiving hopper and the enclosure for the scalping screen and crusher, showing the runway for carrying hand-broken stone to the crusher

York Highway Specifications is obtained from the largest holes of the screen, and is 1½ in. to 2¼ in. in size. The 3A stone when mixed with the rejects of this screen which have previously passed the 2¾-in. perforations in the scalping screen make up the No. 3 stone. The No. 2 stone is obtained through 1½ in. perforations. The jacket separates the sand and the smallest stone, the latter dropping to a bin for No. 1 stone (¼-in. to ¾-in.), while the former is taken to a No. 7 Telsmith settling tank. Here the coarse, or concrete, sand is deposited, while the finer sand passes off in the overflow from the plant. Provision has been made to install a second settling tank to recover this fine sand, but the installation has not yet been made.

Ray W. Wingate

Water is supplied for washing from the creek beside the plant by a centrifugal pump delivering 600 g.p.m. This pump was built by the Moore Turbine Co. of Wellsville, N. Y., and is direct connected to a 30-hp. Crocker-Wheeler motor.

Storage Bins

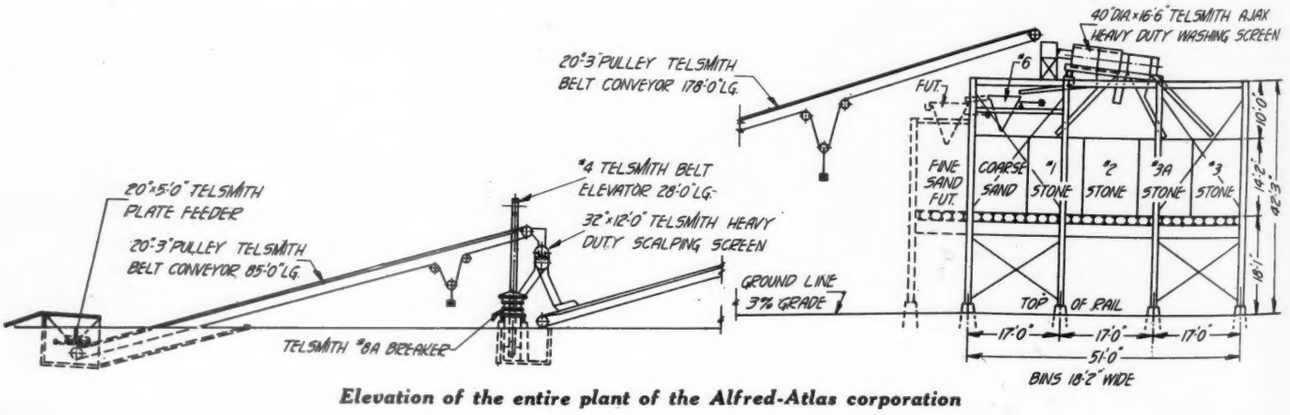
There are five bins, each equipped with a chute at the side for loading to cars and a gate underneath for truck loading. Quadrant type gates are used for both the car-loading chutes and the truck gates, the former measuring 16x18 in. and the latter measuring 20x18 in. A spray of water from a 1¼-in. line is directed on the gravel as it slides down the loading chutes. This thoroughly washes off the sand or other small particles that accumulate in the bin due to movement of the gravel upon itself in its travel from the screen and in the bin. This water passes off through perforations in the chutes. The size of these perforations varies in the different chutes, depending on the size of the gravel being handled.

The Alfred-Atlas plant is located beside the main New York-Chicago line of the Erie railroad at Alfred station. There is a siding beside the plant for loading and this also provides storage space for 15 cars. No car puller is used at present, as the siding is on a 3% grade, sufficient for use of the gravity system. This siding was cut through a bank of conglomerate of exceptional hardness, considerable difficulty being encountered in getting it through.

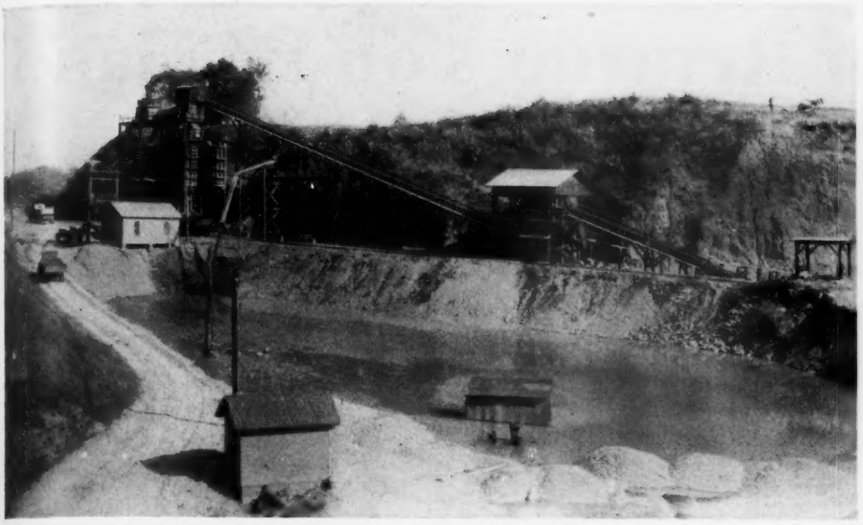
The deposit here is of exceptionally good grade, and with the wide separation of the pits it is possible to obtain material of any required sizing since the deposits of the pits vary widely. The pit at the plant is in a hill rising well above the plant, and containing a considerable quantity of the larger stone. At present this is worked by a Keystone gasoline shovel which loads to trucks, and these in turn dump to the receiving hopper. This appears to be a comparatively expensive method, considering that the deposit is only a few feet from the plant, and Mr. Wingate, the plant engineer, stated that he believed that a cableway excavator system would be installed here instead. This would seem to be the most logical operation, as most of the deposit is near the hopper and somewhat above it.

View beneath the sand-settling box, showing the automatic discharge equipment

At the other pits, a Barber-Greene loader is operated to fill the trucks. This operates



Elevation of the entire plant of the Alfred-Atlas corporation



General view of the Alfred-Atlas plant showing the pond to which the waste water discharges, and the truck driveway up to the loading bins

well for the size of the operation, being more than able to load four or five trucks as rapidly as they can make the trip to the plant and return. The pit now chiefly being operated has a face of approximately 75 ft., and as before stated, is some 300 ft. above the plant. Because of this high climb for the trucks, which is bad even though the trucks carry nothing going up, the company has decided that it was an economy to rent trucks for its operation instead of purchasing its own equipment. There is very little stripping necessary at any of the pits, as it averages about a foot or less. The overburden is removed with horses and a scraper, except at the pit beside the plant where the steam shovel is now being employed for this work.

This plant also has an arrangement for loading bank run gravel directly to the cars, and considerable material of this kind is shipped for use on gravel roads.

Personnel

John J. Merrill is president of the Alfred-Atlas company and J. T. Foody is vice-president. Ray Wingate is secretary and plant engineer, and D. S. Burdick is treasurer. At present the company has no salesmen on the road, but nevertheless found the plant taxed nearly to capacity to get out sand to meet the unprecedented demand of the past season, according to Mr. Wingate. The plant is in charge of Leonard Claire, the superintendent.

Study of Pavement Drill Cores

C. E. FOSTER, construction engineer of the Michigan State Highway Department, recently presented a paper before the Fourteenth Annual Conference on Highway Engineering, University of Michigan, which indirectly is of considerable interest to the producers of rock products. The title is, "The Study of Concrete Pavements from Core Drill Records."

He found that three factors affected the strength and life of pavements, the subgrade, the design, and the workmanship. Under the last he placed the use of proper materials. Of the subgrade he says that it should receive the most careful attention, and some of his specimens show plainly the effect of poor subgrade preparation. Design, he says, is at a standstill and likely to remain so until certain surveys are completed and more information is available. As to workmanship, in the broad sense in which he uses the word, the quality of the concrete in the different specimens is ascribed by him to that feature.

He points out that the striking feature disclosed by the tests is the lack of uniformity in compressive strength. The range between the highest and the lowest is 2800 lb. However, his charts show that only two of the great number plotted had a strength of less than 3000 lb. and three specimens had a strength between 6000 lb. and 7000 lb. and one in excess of 7000 lb.

Mr. Foster believes that much of this ununiformity is due to the use of the old volumetric specifications of the state. He says that as a result of core strength tests the Michigan Highway Department now calls for proportioning by weight and measurement of the water content.

Nothing more is said of the materials than that they passed the departmental specifications, but in the concluding paragraphs it is stated that careful studies are now being made of all available aggregates. This is being done so that advantage may be taken of the data secured to effect economy by designing for a given strength. Such a design would be based upon the characteristics of the materials in combination.

In the discussion of the paper, R. L. Morrison said that cements running all the way from barely passing specifications up to nearly 400 lb. had been used in Michigan highways. He thought that this would account for the maximum difference shown.

High-Type Highways Increasing Rapidly

WITH THE CO-OPERATION of state highway departments, 8184 miles of federal-aid highways were improved in the fiscal year 1927-28 and 2014 miles that had been previously improved by federal-aid were given surfaces of higher type, according to the Bureau of Public Roads, United States Department of Agriculture. This work was done at a total cost of $205,043,784, of which the federal government paid $88,056,984, or 43%, and the states paid the balance.

Under supervision of the bureau, 281 miles of national forest roads were improved, bringing the total improved mileage of these roads to 3775 miles. The national forest road system embraces at present a total of 13,911 miles.

In the federal-aid system there are 187,753 miles of interstate and intercounty highways, of which, on June 30, 71,074 miles had been improved with federal assistance and 1285 miles were undergoing stage construction; that is, were being given a higher type of surface than when previously improved with federal aid.

The 8184 miles improved in 1928 include 2182 miles of graded and drained earth roads, 844 miles of sand-clay, 1836 miles of gravel, 92 miles of waterbound macadam, 464 miles of bituminous macadam, 136 miles of bituminous concrete, 2533 miles of portland cement concrete and 42 miles paved with vitrified brick. There were 54 miles of bridges and approaches.

Federal-aid highways are the most heavily traveled in the country. Increased demands of a growing traffic are shown by the greater increases in the types more suitable for heavy traffic. The mileage of high types of pavements built, such as bituminous macadam, bituminous concrete, portland cement concrete and vitrified brick, increased 19% in 1928, while the mileage of low types, such as waterbound macadam, gravel, sand-clay and graded and drained, increased 9½%.

Kansas Sand Producer Finds Mastadon's Tooth

ONE of the employes of the Victory Sand Co., Topeka, Kan., recently discovered a tooth in the material being dredged from the Kansas river. He took it to a local newspaper office "and it became a greater topic of conversation and speculation even than the elections. Even bets were being placed upon what it was."

Prof. Robert Kingman of Washburn university was sent for and immediately pronounced it as "one of the finest specimens I have ever seen" of a mastodon which roamed the swamp jungles of Kansas centuries ago.

The tooth was 7 in. long and 4 in. wide. The normal, enamel part of the tooth is in remarkable condition, although the bone and upper part is black and somewhat decayed, being hollow. It is in one section and at the point has eight barbs, as a man's molar.

The Effect of Retarders on Portland Cement Clinkers*

Plan of Investigation—Experiments—Results—Interpretation—Conclusions

By Ernest E. Berger†

A LARGE NUMBER of laboratory investigations and some plant tests have been conducted to determine the effect of the various retarders upon the properties of portland cement. The apparent divergence in results obtained by different investigations, however, has made it difficult to form any definite opinion as to the conditions under which the various retarders may be efficiently utilized.

The effect of a retarder varies with the type of clinker used, so that in the previous investigation‡ by the Bureau of Mines, the different forms of calcium sulphate were tested with 20 different samples of clinker in order to determine some facts concerning the action of retarders which would be applicable to any cement clinker. In this investigation only one sample of each form of calcium sulphate was used; but since the physical properties of the different retarders, especially of anhydrite, vary considerably in different localities, and since the retarder is reduced to a high degree of fineness when ground with the clinker in the tube mill, it seemed desirable to extend this investigation in order to determine whether the type of anhydrite or its degree of fineness would in any way affect its action as a retarder of cement clinker.

In the investigation which has recently been completed, four samples of anhydrite, one sample of gypsum, and one sample of plaster of Paris were tested with cement clinkers, so that definite information was obtained concerning the action of each form of calcium sulphate.

Results of Experiment

Since a detailed report on this investigation is to be published as a technical paper of the U. S. Bureau of Mines, this article will contain only the general conclusions which have been reached by careful study of the results obtained.

Interpretation of Results

In all previous investigations of the effect of retarders on portland cement clinker, there has been considerable difficulty in interpreting the results so that they would be generally applicable to cement-mill conditions; it is now essential that more fundamental information be obtained concerning the action of retarders in order to determine which retarder is the most suitable for use under any given condition and how to obtain the best results with any form of retarder.

1. *Experimental work to facilitate interpretation of results.*

Since the action of a retarder has been considered dependent upon its solubility, it is not logical to assume that study of a solution from pats of neat cement containing the various forms of retarder should yield valuable information, especially if it were possible to obtain the solution from cement which had been gaged to normal consistency.

The method which was developed for obtaining such a solution may be described briefly as follows:

(1) Heavy paper extraction thimbles which would just fit inside a 50-c.c. centrifuge tube were carefully washed and dried to prevent contamination of solution.

(2) Part of a rubber stopper about ½ in. long and containing a hole about half the diameter of the stopper was fitted into the tapered position of the centrifuge tube.

(3) Immediately after mixing, the neat cement paste was placed in the extraction thimble and supported on the rubber stopper in a clean, dry centrifuge tube.

(4) The tubes were centrifuged for approximately two minutes, and from 1 to 2 c.c. of solution was collected in each tube.

(5) The extraction shell containing the dry cement was removed, and the clear solution was drawn into a pipette, measured, and immediately titrated with 0.01 NHCl to determine its alkalinity.

(6) After titration the solution was acidified further and analyzed for SO_3 content.

2. *Results of experiments.*

This investigation has not been extensive enough to warrant any definite conclusion concerning the action of retarders, but the information contained offers at least a partial explanation for the difference in the results produced by the various retarders. It is desirable, if possible, to extend this investigation, using a larger centrifuge; with the larger quantities of solution thus obtained a thorough analysis of the solution throughout the setting process can be made. This method should be applicable also to a study of the setting of other cementitious materials.

(*A*) *Relation between the retarder used and SO_3 content of cement solution.*

Whereas it was possible to produce a normal setting cement with this particular clinker by using any form of calcium sulphate, Fig. 1 shows conclusively that there is a considerable difference in the action of the various forms of retarders and that the retarder is more effective when ground with the clinker in a ball mill of 200-lb. capacity.

The SO_3 analysis of solution obtained from cement containing the various forms of retarders (see Fig. 2-a) gives some indication as to why the various forms of calcium sulphate should produce different results. The solubility of natural anhydrite is lower than any other form of calcium sulphate, and the cement retarder with anhydrite has the smallest amount of SO_3 in solution. The amount of SO_3 in solution is slightly increased by grinding the anhydrite with the clinker, and Fig. 1 shows the activity of the anhydrite is enhanced correspondingly.

The solubility of gypsum is slightly higher than that of anhydrite, and cement retarded with gypsum has a little more SO_3 in solution. The solubility of the gypsum was not increased in this case by grinding with the clinker, but a smaller quantity was required to retard the clinker. The difference in solubility between gypsum and anhydrite does not seem to be sufficient to explain the difference in action of the two retarders; consequently, the rate of solution or some other factor may be of considerable importance.

The solubility of plaster of Paris has not been determined accurately, but Mariginac's* results indicate that it is approximately five times as soluble as gypsum, and an analysis of a solution from cement which is retarded with plaster of Paris shows that there is a much larger quantity of SO_3 in solution than when gypsum or anhydrite is used. Thus it is to be expected that a smaller percentage of plaster of Paris would be required to retard the clinker, and it can readily be seen that an excess of SO_3 may be obtained as plaster of Paris, even though it is not possible to obtain an excess with the other forms of retarder.

(*B*) *SO_3 in solution from cement ground at the mill.*

One factor of particular importance is the

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‡Ernest E. Berger, Calcium Sulphate Retarders for Portland Cement, U. S. Bureau of Mines Report of Investigation, Serial No. 2705 (1925).

*Le Chatelier, Henri, "The Constitution of Hydraulic Mortars." McGraw Hill Co., New York, 1905, page 19.

SO_3 content of a solution which was obtained from cement ground in a large tube mill. As shown in Fig. 2-a, the SO_3 content of a solution from mill-ground cement falls between the gypsum and plaster of Paris curves. Thus it is quite evident that some plaster of Paris is formed when the gypsum is ground with the clinker in the large tube mill. It is also evident that no appreciable amount of plaster of paris is formed in the laboratory mill of 200 lb. capacity and that some modification such as artificially heated ball mills should be adopted if laboratory tests are to be applicable to regular mill practice.

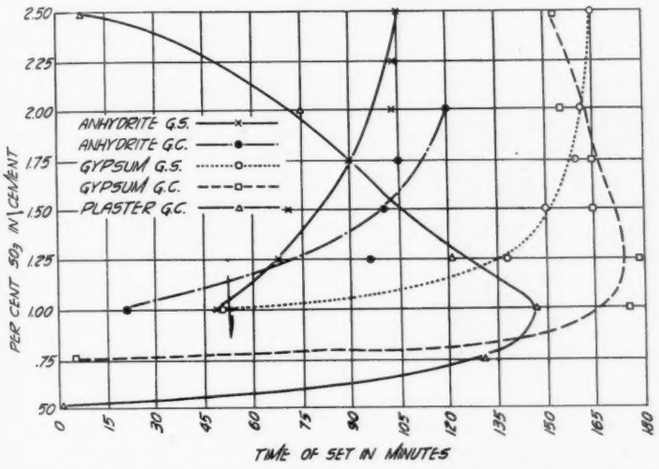


Fig. 1. Effect of various forms of calcium sulphate on set of portland cement

(C) Relation between the SO_3 in cement and the alkalinity of the cement solution.

A saturated solution from cement was found to be decidedly alkaline, and consequently it was of interest to determine how the addition of the various forms of calcium sulphate would affect the pH of this solution. The results obtained in these preliminary tests on the alkalinity of solution may be somewhat inaccurate because of the slight contamination from the extraction shells and the possible effect of amphoteric compounds such as $Al(OH)_3$ in the cement solution. With large amounts of solution the pH can be determined accurately by means of a hydrogen electrode; however, the error occurring in the titration method is quite constant and should give a fair measure of the effect of each form of retarder.

Fig. 2, a and b, shows that there is a definite relation between the pH of the cement solution and its SO_3 content. For this particular cement the normal set occurred between fairly close limits which correspond to a pH of from 12.0 to 12.57. The solutions obtained from cement retarded with the higher percentages of plaster of Paris were the only solutions with a pH below 12.0; this may give some indication as to why the larger percentages of plaster will again produce a quick-setting cement. However, it is not possible without further investigation to state whether the pH of the solution is the controlling or just an accompanying factor in the time of set of cement, but since it is recognized that colloid-chemical processes play an important part in the set of portland cement, it can readily be seen that this reaction could be affected to a large degree by the acidity of the solution in which the setting process occurs.

A method should be devised to obtain large quantities of solution from cement containing the various forms of retarders, as well as to obtain solutions from cement which have been mixed with the retarders by various methods; thus more definite information concerning the action of the various retarders could be secured and, if possible, control could be exercised over the action so as to render laboratory tests more comparable with mill conditions.

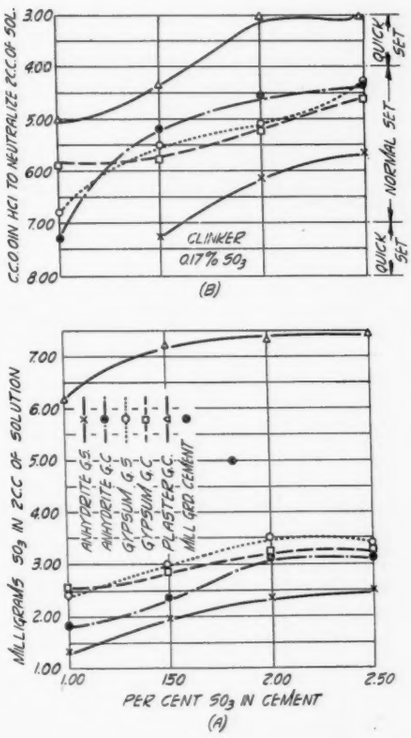


Fig. 2-A—The SO_3 analysis of solution obtained from cement. Fig. 2-B—The SO_3 analysis of solution obtained from cement ground in standard plant mill

General Conclusions

1. Although it is sometimes possible to produce a normal setting cement with straight anhydrite, a larger percentage of SO_3 is required with it than with gypsum or plaster of Paris. Two per cent of SO_3 as straight anhydrite may be below the minimum required if the clinker is difficult to retard.

2. When an equivalent mixture of anhydrite and plaster of Paris is used as a retarder, a smaller percentage of SO_3 is required than with straight anhydrite; mixed retarders should be suitable except where the maximum amount of SO_3 as gypsum is required for proper retardation.

3. The plasticity of cement retarded with anhydrite is lower than of that retarder with gypsum or plaster of Paris, but the plasticity of cement containing mixed retarders is equivalent to that of cement retarded with gypsum or plaster of Paris alone.

4. The strength of cement retarded with plaster of Paris is generally higher than of that retarded with anhydrite or gypsum alone, but cement containing an equivalent mixture of anhydrite and plaster of Paris is as strong as cement containing any other form of calcium sulphate.

5. There was practically no difference in the results obtained by the different samples of natural anhydrite. However, the fineness of the anhydrite was of considerable importance, particularly as regards its effect upon the plasticity of the cement.

6. Better and more uniform results were obtained by grinding the retarder with the clinker than could be obtained by grinding each separately. Consequently, this method is the better to follow in laboratory tests.

7. An analysis of the solution obtained from "pats" of neat cement revealed the fact that with gypsum, at least, there is less SO_3 in solution when the cement is ground in a mill of 200 lb. capacity than when the gypsum and clinker are ground together in the large tube mill. This indicates that further modification in the laboratory testing is necessary if the results are to be comparable with mill conditions.

8. A further study of solution from cement retarded with the different forms of calcium sulphate showed that the amount of SO_3 in the cement solution was directly related to the solubility of the retarder used. Thus the much higher SO_3 content in the cement solution retarded with plaster gives some indication as to why it is possible to add an excess of this form of retarder.

9. A study of the pH of the cement solution shows that there is a direct relation between the alkalinity and the SO_3 content of the solution. Whether the pH is the controlling or just an accompanying factor in the setting process of portland cement can only be determined by further experiment.

10. Since more or less indefinite and inconclusive results are being obtained by the present method of studying the action of cement retarders, it is desirable if possible to substitute for this method one which will give more definite information concerning the action of each form of retarder.

What An Industrial Surgeon Has Done to Relieve Sickness from Explosives at Rock Products Plants

A Remedy for "Powder Headache" Is Suggested After Six Years of Study on the Problem

By C. R. Treat, M.D.

Industrial Surgeon Appointee, Texas Employers Insurance Association, Dallas, Texas.
Contract Physician to the Employes of the Southwest Stone Co., Chico, Texas

FOR years dealers in explosives have been searching to obtain alleviation for the so-called "dynamite headache," or "powder headache," as it is frequently known. I am glad to say that a cure has been found at last.

Six years ago I instituted intensively an investigation of this harassing malady. A study of its pathology revealed the causation to be due to the absorption of nitro-glycerin into the system; first, through the upper respiratory tract, that is, by inhalation; and, second, through the pores of the skin in handling. The outstanding feature is that it is not cumulative; in fact, it is rapidly eliminated, the effects in medicinal doeses fading in about two hours. Besides, there is no immunity as applying to drug agents—the phenomenon obtaining in diseased processes only—although a *"tolerance"* is created in some instances, but not so relatively with dynamite. With nitro-glycerin there is no such thing as "tolerance," for the reason that it is very rapidly eliminated. All drugs that are rapidly eliminated do not allow of "tolerance," but those that are eliminated slowly are cumulative and practically permit of a physiological "tolerance" becoming induced.

Effects of Explosives on the Human System

Now, the first effect of nitro-glycerin being taken into the system in moderate amounts is that it produces its characteristic physiological action, viz., a dilatation of the blood vessels all over the body, with a concomitant fullness in the head. When absorption goes a step further and is sufficiently great, the initial symptoms of poisoning become manifest by an over-dilatation of the blood vessels in the brain, which is directly responsible for the well-known intense throbbing and sickening headache all too familiar to those who work with dynamite and nitro-glycerin explosives.

Considering the pathological action of nitro-glycerin in producing this symptom, I realized that there should be accordingly a physiological antidote that would exert its action directly opposite. A physiological antagonist, ergot, was an agent producing a counterpart effect, so I proceeded to use it in a number of cases, but, to my bitter disappointment, it utterly failed to yield results. Carrying my investigation further, I enlisted the services of a reviewer to cover the literature of the allopathic, homeopathic, and eclectic schools of medicine on the subject. I further consulted the investigation department of the *Journal of the American Medical Association,* also several other leading medical journals of this country and the Chemical Warfare Service at Washington, D. C.

Dr. C. R. Treat

ALTHOUGH ROCK PRODUCTS has frequently printed articles on safety in the plants of our field, there has been relatively little published on the parallel subject of occupational diseases and the health of workers in general. The accompanying article by Dr. C. R. Treat, who has already contributed material along the same line to ROCK PRODUCTS, follows this important line. It outlines the study made in the interest of one particular class of rock products workers—the powder men—to afford relief from a malady which is particularly distressing, though not necessarily dangerous. We are glad to bring this information to the notice of the industry, particularly as we know that Dr. Treat's work has been largely carried on for the satisfaction he has gained in affording this relief to the worker.—The Editors.

Formulation of the Compound

Delving into this mass of data, and giving it considerable thought and study, it was concluded that we must possess available drugs which, when combined, would counteract the phenomenon. I formulated a combination consisting entirely of vegetable origin, containing mainly yellow jessamine (Gelsemium), Calabar bean (Physostigma), and henbane (Hyoscyamus), together with other synergists, and the recently discovered Ephedrine, and made up extemporaneously a batch of capsules, incorporating these various ingredients, for dispensing. The conclusions were reached empirically, rather than by meeting pathological indications.

I then proceeded to carry my experiments further, and as there was ample material to demonstrate the efficacy of the remedy, it was possible to prescribe it whenever the occasion demanded, besides sending a sample to the Institute of Makers of Explosives, New York, for their opinion. After using the formula for several hundred routine cases, it was observed with a great deal of satisfaction that it was effective, without a single failure. To date the results have been uniform, without even a single exception in any isolated instance. Moreover, this remedy not only cures the headache after it comes on, but will also prevent it if taken before the individual engages in working with explosives.

Accordingly, for further use, several thousand tablets of this formula were made up by a reliable pharmaceutical house and these are available (gratis) to anyone in sufficient

number to give a thorough tryout. A copyright is pending at the present time on the formula.

During the course of the study, several prominent companies which manufacture explosives were consulted, and in answer to our inquiry as to whether there was any known cure for "powder headache," the replies were practically uniform that there was none such in extant. The following letter is representative of the attitude of the makers of explosives in general:

HERCULES POWDER CO., INC.
Wilmington, Del., May 14, 1928.

Dr. C. R. Treat, Chico, Tex.

Dear Sir: We have never found a satisfactory relief for "dynamite headache." Usually nature adjusts itself in two or three days so that men become more or less immune. But sometimes we find that we have men who cannot become accustomed to the physiological effect of the nitro-glycerin and we have to remove them from contact with explosives containing it.

Immunity, to those who enjoy it, is not lasting. Usually old powder workers have some degree of headache on resuming work Monday mornings. Twenty-four or forty-eight hours seems sufficient time for immunity to be lost to some individuals.

A great deal of thought and research have been devoted to the study of nitro-glycerin and its physiological effect, and while a cure or definite relief has not been discovered, this we do know—that the effect is not cumulative. However, a subject with high blood pressure or abnormal heart might be indirectly injured by continuous contact with nitro-glycerin.

Some few of our men use aspirin in appropriate doses; they claim it gives them relief. Personally, the writer worked in nitro-glycerin for a good many years and found the only relief was sleep with elevated head and shoulders. The drinking of any liquids intensifies the headache, and stimulants are still more severe. Truly yours,

JOHN S. SHAW, Manager,
Safety and Service Division.

Notwithstanding the opinion of explosive makers and others to the contrary, permit me to state unequivocally and without fear of refutation, that we now possess at our command a perfect and complete cure. This remedy has stood the most rigid tests, with observations extending over a period of many months. I was led to conduct my experiments, with the subsequent development of a successful cure, by the urgent demand not only manifest by employes suffering and handicapped by this distressing ailment, but also by the consideration of lowered efficiency as a result of it, and by the loss of man-hours entailed.

Hiram Norcross Joins Missouri Portland Organization

HIRAM NORCROSS, recently with the Cowham Engineering Co., and the Consolidated Cement Corp., Chicago, Ill., and formerly head of the Norcross statistical bureau at Chicago, has been elected first vice-president of the Missouri Portland Cement Co.

Safe Handling of Explosives

An Abstract from the Discussion on This Subject at the Mining Session of the National Safety Congress

SEVERAL of the papers delivered in the Mining Section of the National Safety Congress held in New York City last October carried a worth-while message for men in the rock products field. This was particularly so of a paper on "The Safe Handling of Explosives Underground," by S. P. Howell, explosives engineer of the United States Bureau of Mines at Pittsburgh.

Mr. Howell stated in opening that three things are always necessary in the use of explosives, namely, the use of approved explosives, the use of approved methods and adequate supervision. In amplifying these points, he said that a marked safeguard through the use of permissible explosives was that these must pass a friction test provided by the government. Speaking of safe methods, he recommended the use of electrically short-circuited electric detonators to protect from power lines and other stray electric conductors which might be present in the mine. He said that it was not uncommon for a miner to disconnect the short, sometimes because he did not know any better and sometimes because he thinks it saves time. Such miners must be instructed. The company should provide the short-circuted detonators, instruct the firers in their use and finally see that the instructions are carried out. Along the same line of safe practices, the firing cables should be in sections 100 ft. long, with the joints staggered and well insulated. Explosives carried about the mine should be in insulated boxes or bags, and cars for delivering explosives should be insulated, and should not be operated by electric power. The storage box in the mine should be large enough to contain only one day's supply, and should be located at least 60 ft. from the face. No other article should be stored in the supply box.

The rules of the mine should state what explosive is to be used, giving its brand name, since two explosives although equally good may act in entirely different manners. Gelatine permissible explosives are good for work in rock. The supply box in the mine should be painted a distinctive color, and should contain only one day's supply, the unused balance being returned to the surface after each day to prevent its deterioration. Wooden prys should always be used in opening boxes of explosives. No explosives should be carried on cages in the shafts at the same time as men. Open lights and smoking should be prohibited, as should carrying matches and pocket lighters. Detonators and explosives must not be carried by the same man.

An example of good practice in one mine was cited, where the checker at the surface delivers only the amount of explosives estimated that the miner will use during the day, and never over a set maximum figure. The mine is so arranged that the miner in reaching his place of work does not have to cross any electric lines. The shooting is all done by a firer who carries a certain number of detonators. The firer receives a check for each shot fired and this is balanced at the end of the day with his unused stock of detonators. The explosives of the miner are also checked at the end of the day.

Mr. Howell said he believed that gelatine dynamites were preferable in metal mines due to their being plastic and water resistant, and producing few gases. He said they were insensitive to detonation, but warned that they were sensitive to friction.

Speaking of fuses, Mr. Howell recommended that they be prepared on the surface and that the smoldering fuse be eliminated, using instead a fuse with a cool, short, flame. Powder magazines should be be illuminated by a keyless vapor-proof electric light, having its switch outside. In conclusion, Mr. Howell discussed the thawing of explosives, stating that in this country this was practically obsolete, since explosive makers are now producing low-freezing explosives which need no thawing. He said that in Europe this was not as yet so general.

Explosives Discussion

In the discussion which followed Mr. Howell's paper, he was asked his opinion as to the possibility of fuses burning more rapidly than the manufacturers had intended. He stated that he had reached the conclusion that under similar conditions a fuse would not vary 5% in speed either way, but that it was true that it would vary somewhat more when affected by marked changes of temperature or elevation. Mr. Howell also stated that his experiments had shown that the rate of speed did vary with fuse length.

A discussion of the use of the half cartridge was brought up. Mr. Howell pointed out that the makers did not seem inclined to manufacture half cartridges and that frequently a whole cartridge was divided. If half of the cartridge were not used till the next day it would deteriorate, particularly at the end where it was cut from the other half. A frequent cause of poor shots and accidents is that the half cartridge with the poor end up is rammed into a hole and another cartridge is rammed in on top. Imperfect exploding is the result. If the poor end is placed farthest into the hole with the two good ends in contact, the whole charge will be exploded with the exception of the small worthless end, which will have very little effect on the general effectiveness of the shot. This is the safe way.

Hints and Helps for Superintendents

Car Pulling with a Tractor

AT many plants in the rock products field a car puller is not regularly in use, the moving of cars generally being done by gravity. However there is frequently some necessity for moving cars when apparently the means is not at hand, and Stewart and Nuss, Fresno, Calif., has solved the problem by using a tractor for this work at its sand plant. The machine used is a 2-ton Caterpillar Tractor which is also used for other jobs around the plant. By thus doing double duty, the equipment is not a particular added expense for the car pulling, and it is amply able to take care of both jobs. It seems likely that the same arrangement might be profitable in other plants where similar conditions exist.

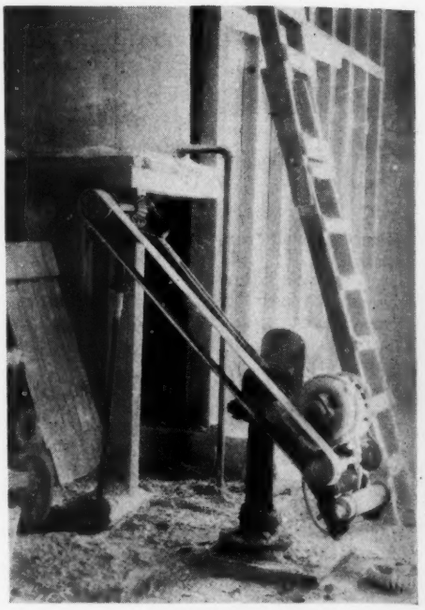
A tractor has many uses around this operation

Mortar Mixer for Gypsum Tile Manufacture

THERE are several types of mixers available for the wet mixing of gypsum stucco or casting plaster for the manufacture of tile and structural or decorative castings. Most of these machines are satisfactory, but the small batch mixer used at the tile plant of the Canada Gypsum and Alabastine Co. at Winnipeg, Manitoba, is particularly novel and is cheaply installed, extremely simple and easy to keep clean.

The building in which the tile is made is a two-story structure, the upper floor containing the stucco bin and the water supply, while the lower floor contains the mixing department and tile molds. There are 12 sets of horizontal molds resting on suitable tables arranged in three banks of four molds each, all the rows of molds being served by several overhead mono-rail trolleys, from which hang cylindrical containers, about 2 ft. in diameter by 5 ft. long. These bucket-like cylinders serve as the mixing tanks and also the containers for transporting the creamy mix to the molds.

The operator, after he has filled a series of molds, thus emptying these large buckets, returns the empty containers via the mono-rail to the end of the room, where each cylinder is filled with the required amount of hot water and stucco. This operation is all conducted without changing the mounting of the bucket. When sufficient stucco has been added to the bucket, the operator pulls the vertical propellor shaft downward, forcing it into the mass. The agitating equipment consists of a 2-hp. motor mounted on the lower end of a centrally balanced steel arm inclined at 45 deg. This short, boom-like arm is pivoted to a suitable floor pedestal and the outboard end can be raised or lowered at will by the operator from the

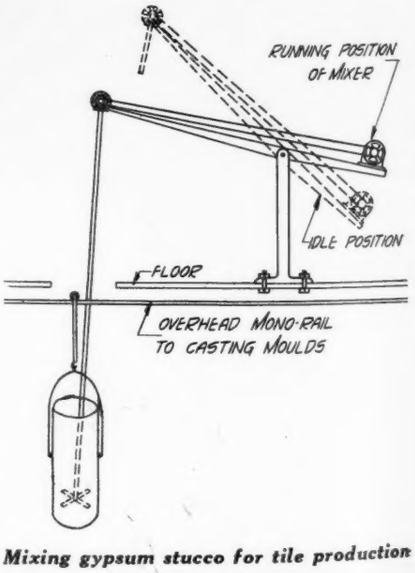


The drive mechanism of the mixer is on the upper floor

casting floor below.

When this outer end, from which hangs the vertical propellor shaft, is pulled downward, the operation also automatically closes the switch and starts the motor. Raising the propellor shaft opens the switch and stops the motor. The agitator shaft is driven by a gear reduction unit at the motor, by means of a short belt mounted on the arm. This belt transmits power to a set of bevel gears, the lower one being keyed to the vertical propellor shaft.

The pedestal with the motor and support

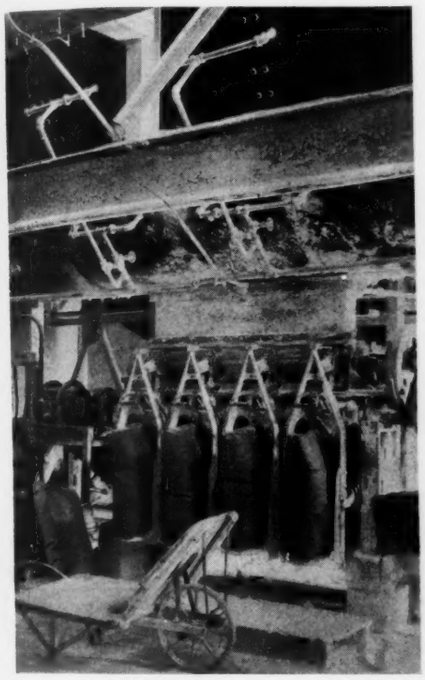


Mixing gypsum stucco for tile production

is on the upper floor over the mixing end of the building. Only the wet end of the propellor shaft extends through the floor above the mixing cylinder.

Speeding Up Sacking of Hydrated Lime

THE sacking of hydrated lime in the usual type of packer is a slow operation when compared to the tonnage turned out when sacking gypsum or cement. It is not difficult for two men to sack and load 25 tons per hour, stored in the car, when sacking gypsum, and even greater tonnages are possible with cement.



Sacking hydrated lime at a Wisconsin plant

The large difference in sacking speeds is mostly due to the physical characteristics of the materials being sacked. Some "flow" better than others, and hydrated lime is inclined to hang up and result in a low daily tonnage. Very often the rate is not due to any fault of the machine, but is due to the fact that lime is not being delivered to the impellers fast enough. To make reasonably sure that the hydrated lime in the bin is being delivered to the throat of the sacking tube, the Marblehead plant of the Western White Lime Co. have installed a pipe manifold beside the bin with a plurality of delivery pipe leading off from this header into the hopper, through which compressed air is forced into the hopper.

When compressed air is used for this purpose, it is advisable to have a bleeder valve at a point very close to the hopper, so that any condensed moisture in the pipe can be drained off, thus preventing any water from getting into the hopper and causing trouble.

An Oxy-Acetylene Branding Iron

MANY public utility and contracting companies employing work crews and pipe or cable gangs brand their ladders, tool boxes and other wooden implements with names or numerals for identification. This is usually done with old-fashioned branding irons which are sometimes quite heavy and require considerable heating in a forge or furnace. Other disadvantages are that as they do not retain the heat for a very long period, they must be frequently reheated, and when too hot the irons tend to char the entire surface of the wood.

The method suggested calls for the use of a stencil through which the flame of the oxy-acetylene welding blowpipe is directed much as a stencil brush would ordinarily be used. The stencil can easily be made in the average shop from ¼-in. flat, cold rolled steel with the letters or numerals laid out, drilled, or cut out by means of the oxy-acetylene blowpipe. Such cuts can be finished by filing with a slight taper or bevel from the top. The thickness of the steel helps to keep the stencil rigid and absorbs the heat, while the bevel on the letters directs the flame more effectively.

Stenciling by the use of an oxy-acetylene torch

The best results will be obtained if the stencil is clamped in place and an extremely small neutral flame used. A little experimenting will enable the operator to determine the desired depth of the letters. The stenciling should be done on a clean wood surface and the charred letters brushed out with a stiff bristle brush after the stencil has been removed. Paint, varnish or linseed oil may be applied as a preservative after stenciling.

The work can be accomplished in a fraction of the time required with the old method and with a consequent saving in cost. The result is a clear cut, easily read brand.

Just another proof that the welding blowpipe can be used for many purposes other than merely welding—as in such heating operations where an intense local heat is desired. Thus the welding blowpipe often takes the place of furnace, forge or blowtorch and does a better job.—*Oxy-Acetylene Tips.*

Give the Operator a Chance

IT is safe to say that a very high percentage of the material produced in the rock products industry is hoisted up an incline of some sort or other during the initial stage of its production. Most of the time this operation consists of pulling a car up the incline with a cable and a suitable hoist.

As a general statement this operation is not considered dangerous but at some pit quarries the foot of the incline is so cluttered up with switches, frogs, turn-tables, scales, piles of rock, abandoned pits and quarry equipment, that in the event of a car breaking loose and hurling itself back to the quarry floor, any men working near the foot of the incline would be in grave danger.

Look your quarry operations over carefully and if this hazard is present, by all means clean up the incline or revise the operation so that any men stationed there will have an easy, free and unobstructed pathway to follow to get in the clear in case of a run-away car. Frequent inspection of cable connector links, king pins and use of the many simple devices for preventing the return of the car in an emergency are advisable. But though there are many forms of safety methods and safety devices, yet the simplest and the most fundamental of all is just keeping the place clean around where men are working. This will give them the opportunity to "stand clear" when danger is near.

At least give the operator the chance you would like to have if you were stationed there.

More Evidence of How Federal Trade Commission Is Helping Eliminate Unfair Competition

Paint and Varnish Industry Acts with Government Help to Taboo Bribery and Extravagant "Entertainment" Expense of Customers

THE FEDERAL TRADE COMMISSION announced, October 27, that the approval of the commission had been given to three rules adopted by members of the paint, varnish and lacquer industry at the recent trade practices conference held at Atlantic City. Three additional rules, it was stated, were accepted by the commission as expressions of the trade.

A summary of the rules was issued by the commission as follows:

"Commercial bribery as a trade practice is declared to be unfair competition and is condemned as such by the paint, varnish and lacquer industry of the United States, and by the Federal Trade Commission.

"Rules of business conduct adopted by the paint, varnish and lacquer industry at a trade practice conference held last August, at which 60% of the industry, based on volume, was present, have been acted on by the commission.

Three Rules Approved

"The first rule, covering commercial bribery, and two other rules, were affirmatively approved by the commission. In the first rule the industry agreed not to 'permit the secret gift of any commission, gratuity or other thing of value to employes of concerns to whom we sell; and we further agree not to allow our salesmen expense money for any other purpose than for legitimate expenses, and not to permit any funds to be dispensed in any illegal way to influence business.'

"Members of the industry further agreed 'to permit the Federal Trade Commission or its duly authorized agents, at all reasonable times, to have access for the purpose of examination, to any of our records which may be necessary for investigation of commercial bribery, without resort to legal process.' The second and third rules, dealing with misleading advertising and misbranding, were also affirmatively approved by the commission."

The full text of the commission's statement to the paint, varnish and lacquer industry, as sent out October 27, is as follows:

A trade practice conference was held for the paint, varnish and lacquer, and allied industries, at Atlantic City, N. J., on August 1, 1928, at which G. S. Ferguson, Jr., commissioner of the Federal Trade Commission, presided, assisted by M. Markham Flannery, director of trade practice conferences. Approximately 60% of the paint, varnish and lacquer industry, based on volume, was present.

Resolutions Adopted

The following resolutions were proposed, separately discussed, and adopted.

Those which properly constitute rules of business conduct on the subjects covered have been designated as Rules 1, 2 and 3, and have been affirmatively approved by the commission. Those relating to committee work and which request a course of action by the commission are designated as Resolutions A, B and C, and are accepted by the commission as expressions of the trade. In respect to Resolution "C," the commission will be governed by its statutory duty to proceed in any individual cases only as the public interest may require.

Rule 1.—Whereas the Federal Trade Commission has ruled that the secret payment of commissions, rebates, gratuities or other valuable considerations to employes of customers, or other purchasers of goods or commodities, to influence business, constitutes an unfair method of competition; and

Whereas, in 1917, shortly after the creation of the Federal Trade Commission, the National Varnish Manufacturers' Association and the Paint Manufacturers' Association of the United States separately adopted an agreement pledging themselves to cooperate with the Federal Trade Commission to eliminate such practice, and individually agreeing for themselves, their companies, their salesmen and other employes "not to permit the gift of any commissions, gratuities, or other things of value to employes of concerns to whom we sell," and "not to permit any funds to be dispensed in any illegal way to influence business;" and

Whereas this agreement was offered for signature to all paint and varnish manufacturers of the United States and was signed by all members of both associations and by many manufacturers not members of either association; and

Industry Creates "Unfair Competition Bureau"

Whereas, in furtherance of such pledge to co-operate with the Federal Trade Commission, the industry immediately created an Unfair Competition Bureau, with headquarters at Washington, and has maintained such bureau at its own expense, continuously co-operating with the commission in the elimination of commercial bribery and other unfair methods of competition; and

Whereas both associations thereupon amended their by-laws, to provide for the expulsion of any members found guilty of violating this agreement, and the National Varnish Manufacturers' Association did thereafter expel a member on proof of violation; and

Whereas in 1926, on the consolidation of the National Varnish Manufacturers' Association and the Paint Manufacturers' Association of the United States this agreement was readopted and signed by the members of the consolidated association and by many non-member manufacturers:

Now, therefore, be it resolved: That the following agreement be adopted as the standard trade practice of the paint, varnish and lacquer and allied industries;

Whereas, the Federal Trade Commission having decided that the practice of, directly or indirectly, secretly giving or offering to give to employes of customers or prospective customers or those of competitors' customers or prospective customers, without the knowledge or consent of their employers, as an inducement to cause their employers to purchase or contract to purchase paint, varnish, lacquer and kindred products, or to influence such employers to refrain from dealing or contracting to deal with competitors, without other consideration therefor, money or anything of value, is an unfair method of competition; and

Whereas the members of the paint, varnish and lacquer and allied industries are in full sympathy with that purpose and wish to co-operate with the Federal Trade Commission to eliminate commercial bribery;

Therefore, we, the undersigned, hereby agree for ourselves individually, our respective companies, salesmen and employes, not to permit the secret gift of any commission, gratuity or other thing of value to employes of concerns to whom we sell; and we further agree not to allow our salesmen expense money for any other purpose than for legitimate expenses, and not to permit any funds to be dispensed in any illegal way to influence business.

We further agree to permit the Federal Trade Commission or its duly authorized agents, at all reasonable times, to have access for the purpose of examination, to any of our records which may be necessary for investigation of commercial bribery, without resort to legal process.

Misbranding Quality

Rule 2.—Be it resolved, that advertising by use of the printed word, or pictorial representation, or by radio, or otherwise, for the purpose or with the effect of misleading or deceiving purchasers with respect to the quantity, quality, grade or substance of goods purchased, is an unfair method of competition.

Rule 3.—Be it resolved: That the branding or labeling of a product, for the purpose or with the effect of misleading or deceiving with respect to the quantity, quality, grade or substance of the goods purchased, is an unfair method of competition.

Resolution A. Resolved, that a special

committee of five be appointed from the industry by the president of the American Paint and Varnish Manufacturers' Association, Incorporated, to confer with the Federal Trade Commission at the earliest possible date for the purpose of putting these resolutions into effect.

Resolution B. Resolved, that the committee of five to be appointed under Resolution A, be further authorized to study the subject of misbranding and adulterating in this inquiry, and if possible to arrive at a plan for suppressing such violations of the law.

Resolution C. Be it resolved, that it is the sense of the paint, varnish and lacquer and allied industries that the commission should prosecute without delay, all pending investigations and proceedings involving the practice of commercial bribery in the paint, varnish and lacquer and allied industries, without regard to other action taken at this meeting, to the end that the outstanding orders be observed and enforced, our customers be protected, and that fair and honest conditions of competition be enforced and maintained.

Work of the Bureau of Mines on Nonmetallics

A VERY LARGE PROPORTION of the total annual mineral production of the United States, which amounts to between $6,000,000,000 and $7,000,000,000 yearly, is represented by the numerous nonmetallic minerals, it was stated recently at the Bureau of Mines, Department of Commerce, Washington, D. C.

The industrial uses of these minerals are exceedingly important, it was explained, since they enter largely into the construction of buildings and highways.

Experiments Conducted

The Nonmetallic Minerals Experiment Station of the Bureau of Mines at New Brunswick, N. J., it was stated, is endeavoring to assist the producers of these minerals in devising cheaper and more efficient methods of production and in finding new uses for their products.

An outline of investigations now being conducted at the New Brunswick Station, made public recently by the Bureau of Mines, follows in full text:

Elimination of Waste in Slate Quarrying—The waste in slate quarrying, which reaches 70% to 90% of gross production, induced the Bureau to attempt to work out better processes for making primary cuts in quarries. Wire-saw equipment was purchased in co-operation with five slate companies and cuts were made under the Bureau's direction.

The preliminary results reported last year have been greatly improved until now it is possible to cut an average of 20 to 25 sq. ft. per hour. In soft vein slate a maximum of 38 sq. ft. per hour has been attained. At the present time 14 pairs of standards and 10 driving outfits are in use or ordered. Great economies are effected from several features; the first cost of equipment is less, operating expenses are less than half, more slate is cut per hour, and shattering is eliminated.

During the last year the progress of these experiments has been reported in Serial 2829, "Use of the Wire Saw in Slate Quarrying."

Survey of Mica Industry—Increasing interest in mica, particularly for radio and electrical equipment, led the Bureau to make a survey of the industry, studying problems both of production and utilization. The information obtained in this survey is being compiled as a Bureau of Mines bulletin.

Limestone for Metallurgical Purposes—Approximately 23,000,000 tons of limestones are used annually for metallurgical purposes in the United States. Most of this is used as flux in the iron blast furnace. Unfortunately, the producers know little about the requirements for metallurgical use of their stone, while the consumers usually know correspondingly little regarding the production. In order to correlate these two viewpoints a study has been made over the past two years and the results are now being prepared for publication.

Work on Cement Retarders

Anhydrite as a Cement Retarder—A large number of gypsum deposits are contaminated with anhydrite to such an extent as to make the mineral unsuitable for use in the manufacture of calcined gypsum products. The disposal of this material has attracted a great deal of attention, and the Nonmetallic Minerals Experiment Station has been conducting tests to determine the desirability of utilizing anhydrite or mixtures of anhydrite and gypsum as retarders for portland cement.

An earlier report on this subject, Serial 2705, "Calcium Sulphate Retarders for Portland Cement," gave a comparison between the action of anhydrite and gypsum, but since the physical properties of natural anhydrite vary to a considerable extent, the work was extended to determine the effect of the types of anhydrite and its degree of fineness on its action as a retarder. The results which have been obtained indicate that the type of anhydrite is of little importance but its fineness affects the plasticity of the cement greatly.

Extraction of Potash from Its Minerals—The most important potash-bearing mineral found in the course of the government's drilling program in the Southwest is polyhalite. This mineral is relatively insoluble so that none of the European methods of potash extraction can be used. The Bureau is studying possible commercial methods for its extraction.

A bibliography covering the European literature on methods of mining and recovery of potash abroad is nearing completion. This concerns chiefly the more soluble salts.

The large quantity of potash-bearing greens and marls of New Jersey have always been attractive to the chemical engineer because of their availability. Many processes for their utilization have been proposed. A bibliography covering this field is soon to be issued. An economic study of several of the processes is now being made in order to indicate the most attractive field for further laboratory study.

Beneficiation of Low-Grade Bauxite—In Alabama, Georgia, Tennessee and Mississippi are large quantities of bauxite too high in silica and oxides or iron to be commercially important at present. Recent studies at the Southern Experiment Station, Birmingham-Tuscaloosa, Ala., have shown that the typical high silica bauxite of the South is not amenable to gravity concentration. Froth flotation tests in laboratory machines have produced encouraging results on material of coarse enough grain to allow liberation of the bauxite by grinding.

The process does not, however, effect a separation of the iron from high iron bauxite. This could be done in some instances by gravity concentration.

Studies in Phosphates

Beneficiation of Low-Grade Phosphate Ores—The present methods of preparing commercial phosphate ore in the land-pebble district of Florida are wasteful as far as the recovery of the fine phosphate material from the ore is concerned. Methods for obtaining a better recovery of the phosphate minerals are being studied at the Southern Experiment Station.

During the past year phosphate and quartz, the main gangue impurity, have been effectively separated by flotation in the laboratory, with a recovery from the rejected materials from all the washers in the district of from 83% to 95% of the phosphate in concentrates of commercial grades. Work is now in progress to develop the most economical reagent combinations and to determine possibilities of treating unground phosphatic sands.

Concentration of Fluorspar Ores in the Illinois-Kentucky District—Deposits of low-grade fluorspar ores are not uncommon. On the other hand, the demand is largely for a grade of spar with at least 98% CaF_2 and less than 1% of silica. Laboratory experiments showed that this grade, known as acid spar, could be obtained by flotation of certain ores. Those ores in which the fluorspar was greatly disseminated were not amenable to such treatment. A paper on "Flotation of Fluorspar Ores for Acid Spar," giving certain of the results, has been published.

The classification and tabling of fluorspar ores presented difficulty due to the small differences in specific gravity between the various minerals. A paper on "Tabling and Classification of Difficult Ores," incorporating these theoretical deductions, will be issued.

New Testing Laboratory of National Crushed Stone Association

Recently Installed Equipment at Washington

By A. T. Goldbeck

Director of the Bureau of Engineering, National Crushed Stone Association

IN recognition of the fact that research has become a vital activity of their industry, the producers of crushed stone have initiated a program of investigation and have provided their national organization with the necessary facilities for research work. It is not within the scope of the present article to discuss the researches to be conducted, but rather to give some idea of the testing equipment now available at the headquarters of the National Crushed Stone Association in Washington.

Up to July, 1928, the offices of the association were located in the heart of the business section of Washington. When, however, it was decided to establish a testing laboratory and add research to the other functions, it became necessary to seek additional floor space, and it at once became evident, that to conserve time and to use the personnel of the association to the best advantage, it would be necessary to have the offices and laboratory located in the same building. Fortunately, the required space was discovered in the Merchandise Building, located at 14th and S Streets, N.W., only a ten-minute ride from the central business section of Washington.

Laboratory Equipment

The laboratory equipment at the present time includes facilities for screening large size samples and also their reduction by crushing and grinding, down to the size of stone sand or dust, equipment for concrete testing, including compression, transverse, tension and freezing tests of concrete, and also full equipment for the physical testing of stone. This apparatus is housed in three rooms, two in the basement, where the noisy and dusty portion of the work is done, and one on the second floor of the Merchandise Building. These rooms occupy 2110 sq. ft. of floor space and in addition there is storage capacity for the temporary storage of samples amounting to 1050 sq. ft. The moist room in the basement for concrete specimen storage is 17x18½ ft., with an area of 315 sq. ft. A total of 3475 sq. ft. of space is thus devoted to laboratory work and in addition there is an office space of 1083 sq. ft., or 4558 sq. ft. in all.

Equipment for Physical Tests on Stone

The equipment for the physical testing of stone is located on the second floor. For the preparation of specimens to be used in the impact test for toughness and in the Dorry hardness test, a diamond core drill, a diamond saw and a grinding lap are used. All three of these machines are shown in Fig. 5. The impact machine for making standard toughness tests on rock, the Dorry hardness machine for determining the so-called hardness coefficient and the Deval abrasion machine used for determining the percentage of wear, or, as it is sometimes expressed, the French coefficient of wear $\left(\frac{40}{\text{Per cent of wear}}\right)$ are all shown in Fig. 1. This equipment has been checked to see that it complies in all respects with the standard requirements for the respective tests. Each machine is independently motor driven and all of the electrical controls have been worked out for ease of operation and convenience.

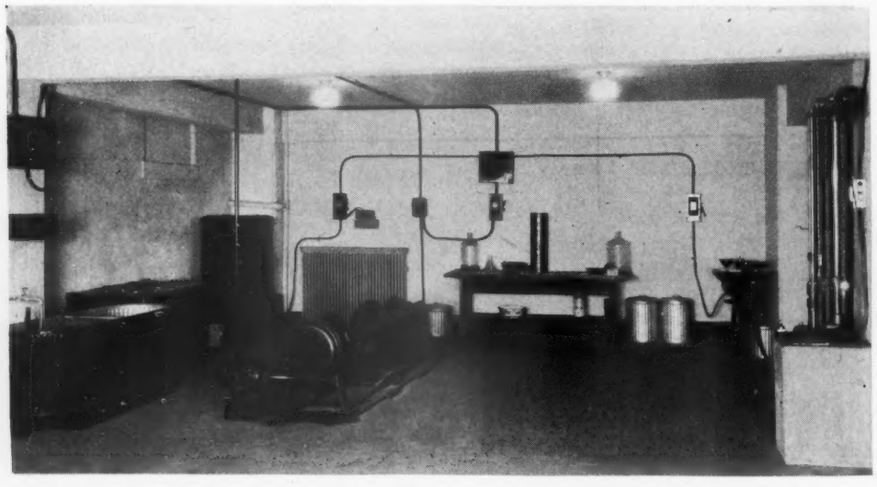


Fig. 1. Part of laboratory showing the impact, hardness and abrasion machines

Screen Tests

For conducting laboratory screen tests a Tyler "Ro-Tap" sieving machine has been installed provided with square-opening sieves arranged in sizes from the No. 200 mesh up to 1 in. Sizes larger than 1 in. are used with screens 18 in. in diameter for hand-shaking. This equipment was supplied by the W. S. Tyler Co. The "Ro-Tap" screen is housed in a celotex lined cabinet to reduce the noise and dust to a minimum. This cabinet is seen in the left corner of Fig. 1.

In addition, a set of screen plates having circular openings ⅛, ¼, ⅜, ½, ⅝, ¾, 1, 1¼, 1½, 1¾, 2, 2½ and 3 in. were supplied by the Hendrick Manufacturing Co. They have been fitted in rectangular wood frames which are installed in nestable form in a rocking cradle. The laboratory is thus provided with apparatus for making both square and round opening screen tests.

Cement and Mortar Testing Equipment

The cement and mortar testing equipment for the routine testing of cement, sand and other fine aggregates used in the investigations possesses several unique features. The equipment thus far includes a cement mixing table having a plate glass top for the mixing operations, a 1000-lb. Riehle cement tester, the necessary briquet molds to which there will later be added small cylinder molds, a boiling apparatus, Vicat apparatus for determining normal consistency and time of set, measuring burettes of various capacities, including a special burette used at the mixing table, a Le Chatelier apparatus for determining specific gravity and a storage cabinet which combines a moist closet for the initial storage of briquets and storage tanks for long-time storage under water.

This storage cabinet is unique in its combination of the two functions of 24-hour moist air curing and long-time water storage. It was designed in the Bureau of Engineer-

ing of the association and is made of asbestos lumber, moisture-proofed with a new type of waterproofing compound developed by Dr. E. C. E. Lord of the U. S. Bureau of Public Roads. All of this equipment is shown in Fig. 3, and a more detailed view of the storage cabinet is shown in Fig. 4. In the extreme upper left corner there will be noted a spray which insures a constantly moist atmosphere of uniform temperature in the upper compartment of the cabinet which is used as a moist closet for the storage of cement briquets immediately after molding. The briquet molds will be noted on the racks supported on the upper immersion tank, and there will also be noted the two additional immersion tanks filled with water. The upper tank overflows into the middle, and the middle tank into the lower one. The water entering the cabinet through the spray is controlled to a temperature of 70 deg. F. by the use of a Powers regulator valve which operates thermostatically. This cabinet gives every promise of being a complete success and provides constant temperature and moisture conditions which are so desirable in testing cements and mortars. A chemical balance donated by the Taylor-

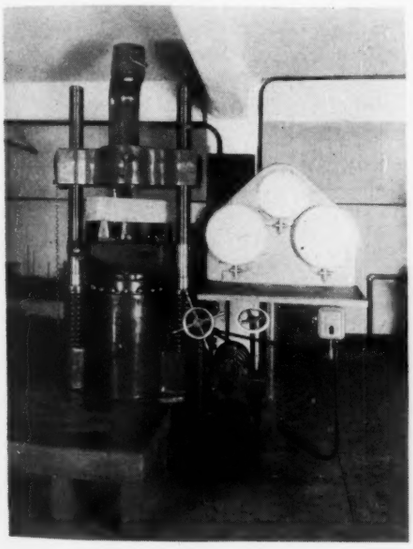


Fig. 2. Machine for testing concrete specimens for compression, bending and tension

Wharton Iron and Steel Co. completes the cement testing equipment.

Concrete Testing

Concrete specimens are being tested for strength in three ways—in compression, tension, and as beams. The testing machine shown in Fig. 2 is of a comparatively new design, which, however, employs a well-established type of weighing mechanism. It is made by the Southwark-Emery Co. of Philadelphia and is of 300,000-lb. capacity in compression and bending and 60,000-lb. capacity in tension. The load is applied hydraulically by means of a Hele-Shaw electrically-driven pump. The weighing system

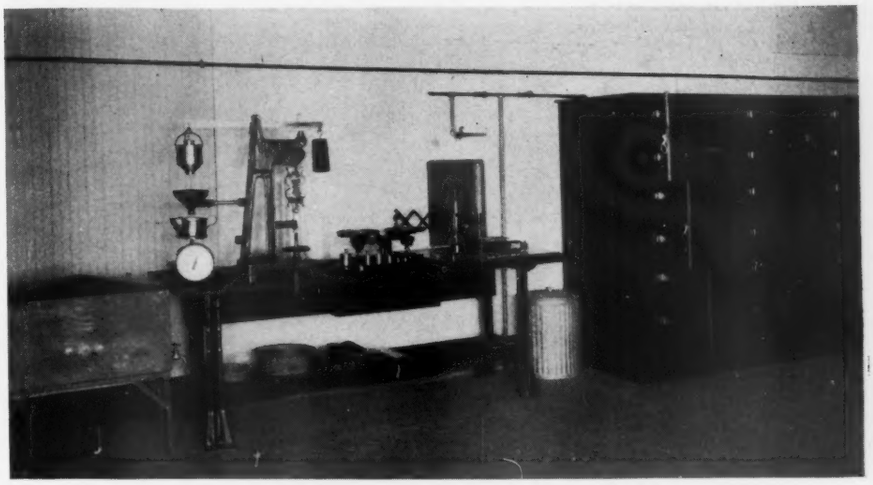


Fig. 3. The cement and mortar testing equipment and the storage cabinet

of the machine is very sensitive. Dependence is not placed on the measurement of the pressure in the hydraulic ram, but the entire system of weighing is independent of the load-applying system. Any load applied by the machine is transmitted through the pulling screws to a very sensitive hydraulic sack and in turn the pressure created within the sack is transmitted to the weighing gages. The entire load-weighing mechanism was calibrated while mounted on the machine, and through the co-operation of the U. S. Bureau of Standards periodic calibrations were made to determine the constancy of calibration of this most important piece of equipment. A Whittemore-Petrenko calibrating ring was used for this purpose and the work was done by Capt. S. N. Petrenko of the Bureau of Standards. Our fortunate situation in Washington makes this assistance from the Bureau of Standards feasible.

Special tools have been devised in the engineering bureau for use in making tension tests on concrete and also beam tests. Every effort is being made to eliminate the errors in beam testing which have resulted elsewhere through the neglect of certain principles which should not be overlooked, among which may be mentioned the prevention of eccentricity of loading and the avoidance of horizontal components of reaction due to the restraint of the reaction blocks. This transverse testing equipment will be described in detail elsewhere. It is seen mounted on the testing machine in Fig. 2.

Freezing Tests on Concrete

One very important kind of test to be made on concrete and concrete aggregates is one which will determine the durability of these materials. It is becoming recognized more and more that the durability of concrete, or its resistance to the action of the weather, is one of its most important attributes. Often the soundness of the coarse aggregates has been called into question, and consequently it becomes necessary that means be at hand for making investigations on the resistance to freezing and thawing of both concrete and concrete aggregates. For this purpose there has been installed a six-compartment "Frigidaire" ice cream cabinet which has been provided with a water-cooled compressor driven by a ½-hp. motor. This is a somewhat heavier compressor than is ordinarily used with this type of equipment.

The specimens, as will be seen in Fig. 6, are placed in galvanized cans which are filled

Fig. 4. The storage cabinet which combines the function of moist air curing and long-time storage

with water. These cans in turn are partially immersed in alcohol which is placed in the opening provided in the cabinet. The alcohol serves as a medium for the rapid conduction of heat away from the specimens to the brine circulating within the cabinet, and by the use of this device it is possible to effect very rapid freezing of the concrete specimens. A temperature of 20 deg. below zero may be attained and it is possible to conduct three alternations of freezing and thawing per day.

After each freezing the galvanized cans containing the frozen specimens are removed from the cabinet and are placed in a hot water tank which is seen immediately adjacent to the cabinet. Hot water is provided

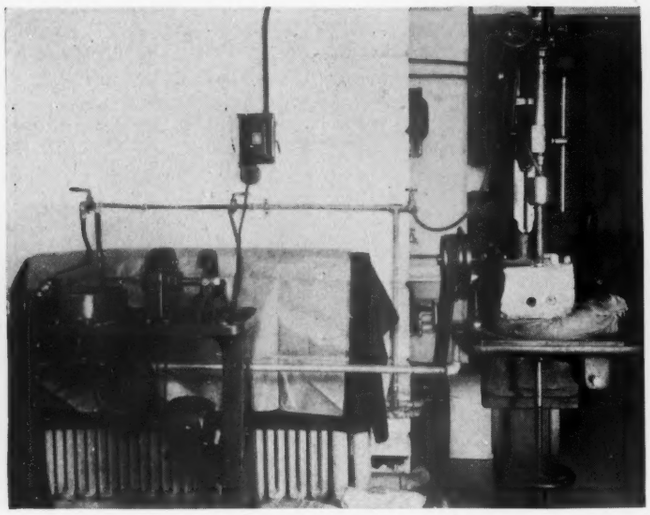


Fig. 5. A corner of the laboratory showing the diamond core drill, the diamond saw, and the grinding cap for preparing rock samples

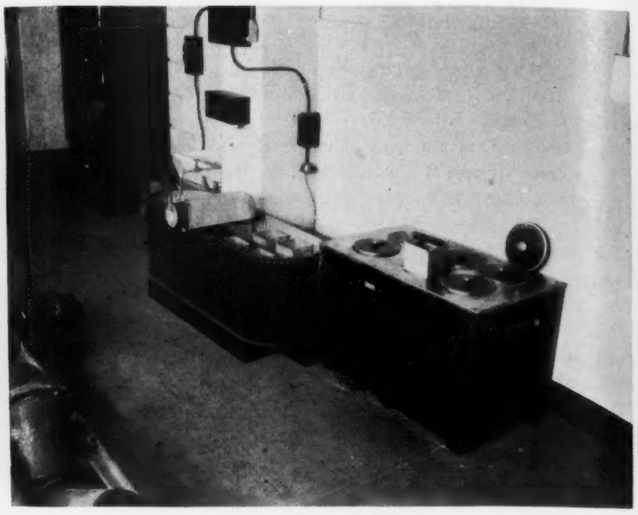


Fig. 6. Apparatus for freezing and thawing tests includes an ice cream cabinet and galvanized cans for holding the specimens

from the hot water tap and the specimens are thawed within a few hours. The soundness of rock may be very readily ascertained with this apparatus and, moreover, by its use comparisons may be made with the various accelerated tests for the soundness of rock.

Screening of Coarse and Fine Aggregates

Twenty or thirty of the samples required for one of our investigations are quite large and involve approximately 25 cu. ft. of material. Each of these samples must be screened to given sizes and consequently it was necessary to install mechanical equipment for this purpose. The type of screen finally decided upon was a small size "Hummer" made by the W. S. Tyler Co. Screen plates have been provided extending from No. 80 to 2½ in. in size, including Nos. 80, 50, 20, 10 and 4, and ⅜, ½, ¾, 1, 1¼, 1½, 1¾, 2 and 2½ in. This equipment is shown in Fig. 7, in the rear of which will be seen the racks supporting the extra screen plates. This apparatus has been found to be satisfactory for our purpose, particularly on the smaller sizes. In this figure will also be seen a gas drying oven used for the drying of small size samples and also a standard water heating system for the provision of hot water wherever needed in the laboratory.

The Allis-Chalmers Manufacturing Co. of Milwaukee supplied the grinder which crushes material from ½ in. down to 10 mesh and finer. This grinder is seen in the picture at the extreme left. There will also be seen a small Traylor gyratory crusher which has proven very useful for the reduction of stone to small sizes approximately ⅝ in. and smaller in diameter.

Molded Concrete Specimens

In Fig. 8 are shown the various pieces of apparatus used in the molding of concrete specimens. There will be seen 6x6x36-in. beam molds constructed after our own design, employing steel channel sections, 6x12-in. cylinder molds for use in compression and tension tests, a flow table for determining the consistency of concrete and a slump cone for the same purpose, the necessary platform scales graduated to one-tenth of a pound for weighing out the various batches of materials, a galvanized mixing pan, and other tools required in this work.

Concrete Moist Room

The specimens are removed from the forms a day after molding and are conveyed by means of a rubber-tired truck to the moist room which is seen in Fig. 9. Fortunately, it was possible to select a room for this purpose which is almost ideal. It is in the basement, where the temperature remains quite constant. It is an interior room surrounded by thick brick walls and it was merely necessary to waterproof it to trans-

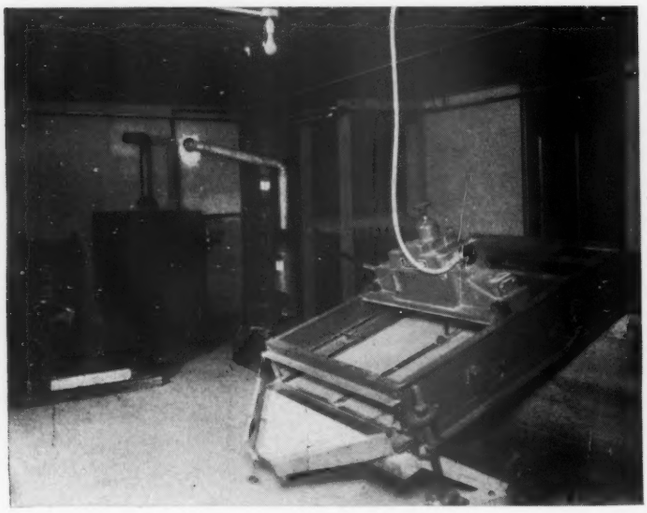


Fig. 7. Vibrating screen installed at the labortary for preparing aggregate samples, with the racks for the extra screen plates behind

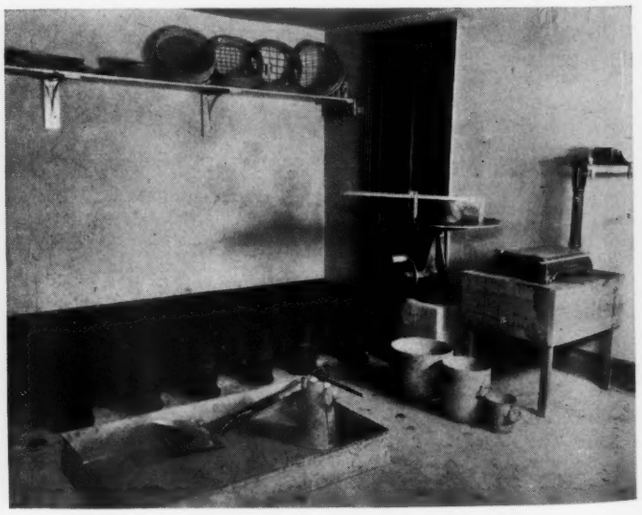


Fig. 8. The apparatus used for molding the concrete specimens, including beam and cylinder molds, a flow table and a slump cone

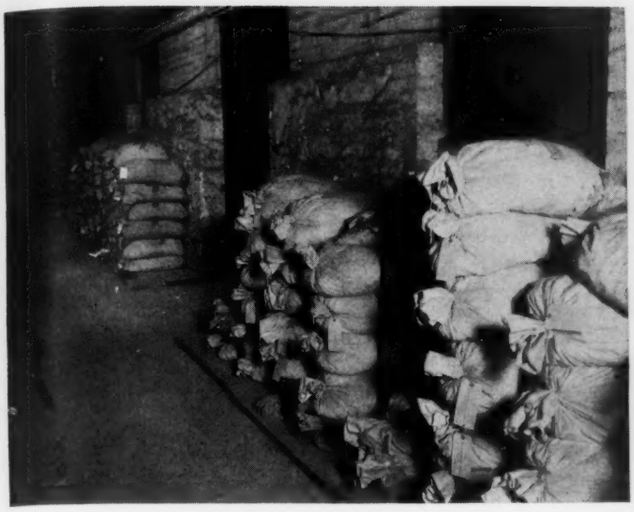


Fig. 11. Material in storage, screened and ready for use in the laboratory

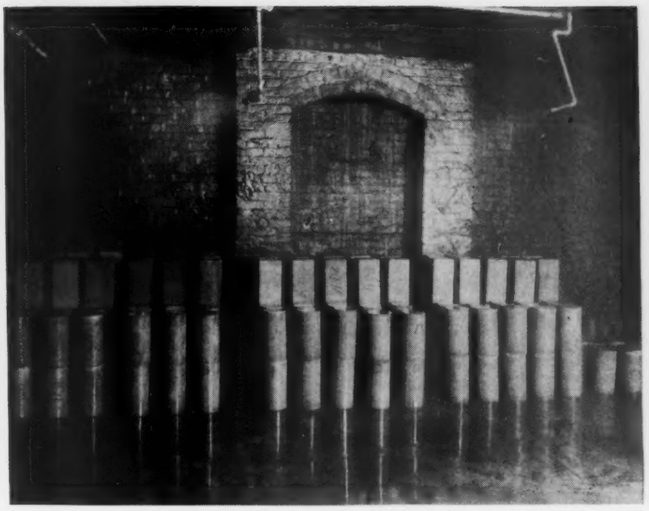


Fig. 9. The moist room at the laboratory with some of the specimens curing under the sprays

form it into a moist room for the storage of the concrete specimens. Provision has been made to use four mine sprayers, and the type finally selected is that of the American Moistening Co., having a No. 030 orifice. Compressed air is not used in connection with these sprayers, as it does not seem to be necessary. Minute particles of water are floating continuously in the atmosphere of the room and the specimens are receiving ideal curing. The water which supplies these sprays is first regulated in temperature by means of the Powers regulator valve shown in Fig. 10. Hot water enters one side of the valve and cold water the other, and by means of thermostatic control the desired temperature of 70 deg. F. is obtained. The same valve regulates the temperature of the water supplied to the moist cabinet and storage tanks for cement testing previously described.

One very important feature of the laboratory is the ample space for the storage of materials, and in Fig. 11 will be seen a small portion of the samples which have been received and which have been screened to the desired sizes awaiting their use in concrete.

Certain problems are of pressing importance and the equipment which has been purchased is that which is necessary to undertake these particular problems. At other investigations become important, additional equipment will have to be added. It has been the aim to obtain apparatus which is not only convenient and speedy of operation but which will give trustworthy results. Research is as practical a matter as the routine production of crushed stone. A high standard of accuracy will be maintained, but it is not proposed to carry that accuracy to a meticulous extreme out of all proportion to the character of tests involved. It will be the aim of the laboratory to obtain practical results which will be useful and valuable in solving some of the problems in aggregates with which the engineers and producers are now concerned.

Canadian Tariff on Limestone Being Considered

HAVING DISPOSED of the major submissions relating to coal, iron and steel, the Canadian tariff advisory board recently focused its attention upon an application for revision of existing duties on limestone.

The reference was originally filed by J. Sutton Clark of St. George, N. B. The Winnipeg Supply and Fuel Co. and the Tyndall Stone Producers' Association of western Canada have since become associated with the submission.

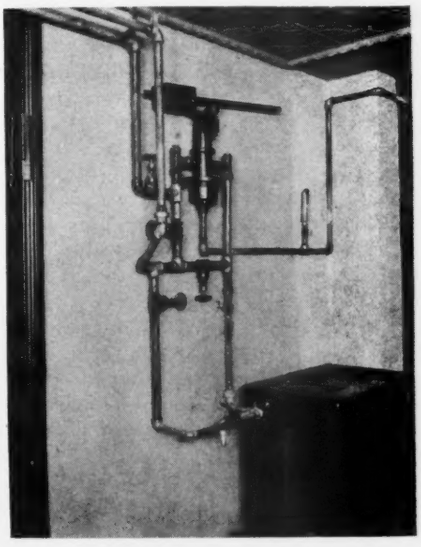


Fig. 10. Temperature regulating valve which controls the heat of the water entering the moist room

In essence, the applicants claim that the industry is laboring under a great injustice, due to the free entry into the country of lime rock and marble.

The United States tariff provides for a duty of $1 a ton on the same commodities. To offset this condition, it is suggested that a reciprocal duty be provided.

At the initial hearing, counsel for Algoma Steel Corp. and the British Empire Steel Corp. asked that limestone for metallurgical purposes be left on the free list. D. C. Henderson, Winnipeg, speaking for the western association, acceded to the suggestion.

Opposed to the application is the Canadian Pulp and Paper Association and the Manistique Lime and Stone Co. of Manistique, Mich., the latter a large exporter to Canada.

John Bain of Ottawa, counsel for those opposing, pointed to the importance of rock quality. He declared that the Canadian limestone industry was prospering, and at present, due to geographical advantage, enjoyed virtually 80% of the business.

A statement to the effect that imported stone was superior to the domestic product was denied by Dr. Wilson of the Federal Department of Mines. Four years' survey, he said, had proved Canada to have stone equal to anything imported from the United States.

Hector Racine, acting chairman, asked the applicants if they would favor a reciprocal free trade arrangement on stone.

"Yes, we are quite willing to take our chances," Mr. Henderson replied. However, if a duty were applied, the price of stone would not be increased in Canada, he added. Domestic competition would be stimulated and native labor would benefit by enlarged markets.

Following conclusion of the case, a reference was introduced by H. F. Wilson, on behalf of the Canada Crayon Co., Peterboro.

The brief read into the board's records asks for upward revision of customs duties on crayons and chalk. Independent classification of the company's products also is urged.

The board adjourned to meet again next January, when final hearing will be given applications of the Canadian iron and steel interests.

Foreign Abstracts and Patent Review

Behavior of Trass Cement in Corrosive Water. The ability of trass, when added to portland cement in preparing mortar for concrete construction in damp ground, to set chemically the lime liberated in the setting of the mortar, in conjunction with the solidifying of the mortar by the addition of trass, have made the cement-trass concrete widely acceptable where corrosive waters are likely to be encountered. Since the trass must be carefully admixed to the portland cement and in the correct proportions, which is carried out with difficulty at construction sites, users of cement have expressed a desire for ready-mixed trass cement. As a result the cement works Oberkassel of the Bonner Bergwerks- und Huettenverein delivered first in September, 1924, a trass cement which contained the following primary constituents in percentage by weight: Moisture 1.10; hydrate water 2.59; CO_2 1.35; acid insoluble 6.84; soluble silicic acid (SiO_2) 23.23; sesquioxide ($Fe_2O_3 + Al_2O_3$) 11.92; lime (CaO) 48.02; magnesia (MgO) 2.99; phosphoric acid (P_2O_5) 0.40; sulphuric acid (SO_3) 1.70. A later shipment showed the following composition in percentage by weight: Moisture 0.89; hydrate water 4.91; CO_2 traces; acid insoluble 5.82; soluble silicic acid (SiO_2) 20.21; iron oxide (Fe_2O_3) 3.25; argillaceous earth (Al_2O_3) 7.24; lime (CaO) 51.87; magnesia (MgO) 3.13; sulphuric acid (SO_3) 2.02. In the standard test the residue on the 75-mesh screen was 1% and that on the 175-mesh screen 20.55%. The setting period started at the third hour and terminated in 7 hours and 15 min., the mortar being 451 parts trass cement and 122 parts water. Eight samples of a mixture of 1 cement to 3 standard sand placed for one day in the air and then in water at room temperature gave an average tensile strength of 347.1 lb. per sq. in. after 7 days; 497.8 after 28 days; 526.3 after 100; and 536.2 after 365 days. The various standard volume-consistency tests were also met satisfactorily by the trass cement. The mortar of trass-cement and standard sand showed after 28 days higher strength values than mortar of trass, cement and standard sand. In February, 1925, 100 samples for testing tensile strength and of a proportion of 1 trass cement to 3 standard cement were placed in a 2½% magnesium sulphate solution, 50 of them fully and 50 only one-half immersed. The liquid level was maintained by a weekly addition of distilled water. Tests were then made for tensile strength after 1, 1½, 2 2½, and 3-year storage periods. All fully immersed samples were in good condition after each observation period (February, 1925-February, 1928). The partly immersed samples showed no deterioration after 1½ years, but after 2 years there were more or less changes in the surface of the halves exposed to the room air, which were considerable after 2½ years, while the hardening process continued at the core. After 2½ years only 19 fully immersed test samples remained, which were then raised one-half way out of the solution; after the 3-year period the edges thus exposed to room air showed also more or less deterioration. The maximum and minimum tensile strengths, their differences and the average tensile strength of the trass-cement samples were as follows in lb. per sq. in.:

Years immersed	1		1½		2		2½	*3
	half	full	half	full	half	full	half	full
Maximum	596.0	517.7	467.9	593.1	537.6	578.9	699.8	876.1
Minimum	492.1	426.7	339.9	469.4	412.5	426.7	460.8	465.1
Difference	103.9	91.0	128.0	123.7	125.1	152.2	239.0	411.0
Average	533.4	472.2	411.1	522.0	472.2	520.6	561.8	593.1

*2½ years fully and ½ year partly immersed.

The average values of the entirely immersed samples increased continually and those of the one-half immersed did not. The influence of the corrosive solution upon the tensile strength is shown most clearly in the maximum and minimum values and their differences; the differences increase continually in both groups of samples, but the uniformity in hardening is undoubtedly influenced unfavorably by the corrosive solution, although the hardening proceeds continually to rather high average values. In this test the corrosive solution had a strength of 25,000 milligram of the most dangerous sulphate per liter, whereas in practice in underground concreting work strengths of only a few hundred to a few thousand milligram per liter are encountered, so that the trass cement has proved itself not only highly resistant against sulphate-containing water, but ought to withstand such waters for scores of years, even if not specially coated. The tests showed by the samples exposed to air after 2½ years of immersion that a certain age of the concrete in itself is not protection against the action of sulphate. It was also shown that it takes years to obtain reliable results in cement testing, for had the tests been concluded within 1½ years, the trass cement would have been considered unaffected by the solution. The deterioration of the samples exposed to air after 2½ years of immersion emphasizes the importance of coating cement work to make it impermeable to water, to prevent evaporation of moisture under the coating and its concentration in the concrete structure.—*Tonindustrie-Zeitung* (1928), **52**, 52, pp. 1058-1060.

Dutch Cement Standards. The Associated Cement Plants of Holland have established new standards to be valid until December 31, 1928, which, although not yet recognized by the standardization commission, have found acceptance by the German, Belgian and British cement industry. Accordingly, portland cement should have not less than 1.7 parts by weight of lime (CaO) to 1 part of soluble silicic acid (SiO_2), plus argillaceous earth (Al_2O_3), plus iron oxide (Fe_2O_3); iron portland cement should have at least 70 parts by weight of portland cement clinker and the balance should be granulated, basic, blast furnace slag of the composition:

$$\frac{\text{CaO plus MgO}}{\text{SiO}_2 \text{ plus } \text{Al}_2\text{O}_3} > 1;$$

blast furnace cement should consist of 15 to 69 parts by weight of portland cement clinker, and of granulated basic blast furnace slag of the composition:

$$\frac{\text{CaO plus MgO plus } \frac{1}{2}\ \text{Al}_2\text{O}_3}{\text{SiO}_2 \text{ plus } \frac{2}{3}\ \text{Al}_2\text{O}_3} > 1$$

with a maximum content of 5% MgO. Based upon the weight of test samples dried for 90 min. at 212 deg. F., the maximum content of particles insoluble in silicic acid should be 3% for every cement, the maximum content of magnesia should be 5% in portland cement and none in the iron portland and blast furnace cements; and that of sulphuric acid anhydride 2½% in portland cement and none in the others. A pot of pure cement and water should not start to set before one hour after preparation. The maximum residue of the test samples from the three cements, heated for 90 min. at 212 deg. F. should be 2% in weight on the 900 mm. (75-mesh) screen and 20% on the 4900 mm. (175-mesh) screen except for blast furnace cement where it should be 12%. The minimum strength of mortar test samples from these three cements, prepared of 1 part by weight of cement to 3 parts of German standard sand should be: For 1-day storage in damp air and then 2 days under water 327 lb. per sq. in. tensile strength; and 3555.9 lb. per sq. in. compressive strength in class B, which class is cement of high initial strength; for 1-day storage in damp air and then 6 days under water 256 lb. tensile and 2844.7 lb. compressive strength in class A, which class is ordinary cement; 369.8 tensile and 4978.2 lb. compressive strength in class B; and for 1-day storage in damp air and then 27 days under water 369.8 lb. tensile and 4267.0 lb. compressive strength in class A, and 455 lb. tensile and 6044.99 lb. compressive strength in class B, the temperature of the air and water remaining constant between 59 and 64.4 deg. F.—*Tonindustrie-Zeitung* (1928), **52**, 54, pp. 1103-1102.

Machine-Operated Screens. The stand-

ards for determining the degree of fineness of ground material prescribe sifting by hand-operated screens, since in this method a clogging of the meshes is prevented by occasional shaking and brushing of the screen. A. H. M. Andreasen placed small round-headed brass nails in a machine-operated screen with the material to be screened, in order to prevent clogging of the screens, the meshes being cleaned continually by the nails. More throughs were obtained than with the hand-operated screen; but the point is to determine whether the hand-operated or the machine-operated screen gives the more uniform results in sifting cement or other material. The machine-operated screen required only 5 to 10 minutes for screening.—*Ingenieron* (1928), 18, pp. 225-7, according to *Tonindustrie-Zeitung* (1928), **52**, 53, p. 1091.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

Fibered Cement Board. Asbestos cement boards are manufactured by passing an endless belt through a slurry consisting of a mixture of cement and asbestos pulp which has been previously beaten until the sludge is in a semi-colloidal condition. The endless belt passing through this mixture builds up a layer of material that is dewatered by a suitable suction device, squeezed, and then transferred to another roll for a final high pressure treatment, after which the cement is allowed to set.

The originator of this patent has found that if the dry cement is sprinkled on to the endless belt after it leaves the slurry vat, a stronger board is formed and the process is also more economical. The cement is sprinkled on to the board by means of a revolving brush to which dry cement is fed from a hopper. The action of the brush is to scatter the cement evenly over the board.—*Richard V. Mattison, assignor to Asbestos Shingle, Slate and Sheathing Co.,* October 16, 1928. U. S. Patent No. 1,687,681.

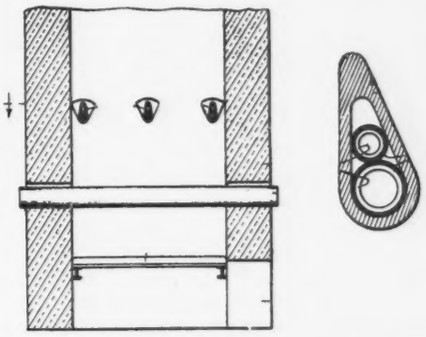
Method of Manufacturing Magnesite Bricks. The patentee describes the old method of manufacturing magnesite brick, pointing out that MgO in itself does not have sufficient bonding properties to make a structurally strong brick and that it is necessary to add up to as high as 7% FeO for bonding purposes. The brick in the metallurgical furnaces and subjected to the high temperature, it is proven by use of the microscope that the brick binder, which is a Mg-Fe compound, fuses and loosens the MgO particles so that portion of the refractory is mechanically swept away.

In his patent he claims that if pure MgO is mixed with a mechanically or a chemically prepared colloidal magnesium hydroxide that this forms an excellent bond, both during the brick-forming stage and during the burning as well. In the furnace the colloidal $Mg(OH)_2$ changes to a semi-colloidal compound, and at still higher temperature (Cone 16) the MgO is changed to a solid block of periclase and is structurally strong and has the excellent refractory properties of pure MgO.

The patent covers the use of colloidal $Mg(OH)_2$ in the manufacture of the usual type of fire bricks, and also covers the construction of furnace bottoms by tamping the pulverized MgO in place with the $Mg(OH)_2$. Methods are described for preparing colloidal magnesium hydroxide.—*Berry M. O'Hara, assignor to American Smelting and Refining Co.,* October 9, 1928. U. S. Patent No. 1,686,876.

Electrically Heated Kiln. The invention relates to a vertical type kiln for burning lime using electrical resistance elements enclosed in heat-resisting, non-oxidizing hollow bars. The heating elements are placed across the kiln at suitable points, and for the purpose of additional strength the outer tubes containing the heating elements are made wedge-shaped with the point of the wedge upward. Also, these bars can be shaken from points outside the heat zone to facilitate the movement of the burned lime down the shaft of the kiln. A grate is recommended near the base of the kiln to support the weight of the superimposed limestone.

By means of this type of kiln, it is claimed, a more uniform and purer product can be obtained, and also the temperature can be



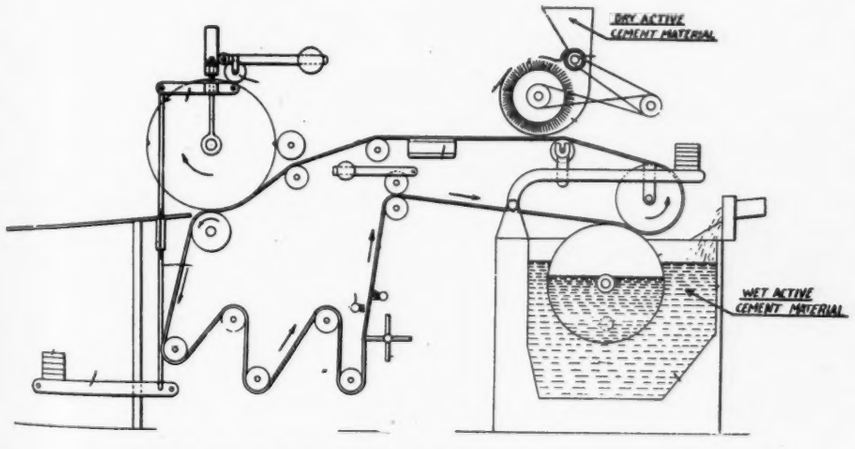
At the left is shown the electrically heated kiln with cross tubes enclosing resistors, and at the right is a cross-section of the hollow crossbar which gives the large heating area and greater strength

kept so low there is no reaction between the CaO formed and any impurities present in the stone.—*Gottlieb Keller, assignor to Aktiengesllschaft Brown Boveri & Cie.,* October 9, 1928. U. S. Patent No. 1,687,025.

Production of Base Exchange Silicates for Water Softening. The patent relates to a method of manufacturing a colloidal alkali metal amphoteric metallo silicate gel obtained by partially drying such gels and then disintegrating the resultant product.

The author has found that a precipitation occurs when strongly ionized salts are present. However, if salts of an inorganic acid are present ionization is not so pronounced and consequently does not exert as great a precipitating tendency. Therefore, he is able to obtain a more uniform and better structural gel.

In carrying his invention into practice, he mixes, as an illustration, 267 liters of $\frac{N}{2}$ aluminum acetate, called solution (A), with solution "B," consisting of 150 liters N sodium silicate and 66 liters N caustic soda and 110 liters of water. He brings solution A and B together at room temperature or below with rapid mixing and allows the resulting gel to stand 24 to 48 hours. Different strengths of solution may be used, but in general the more diluted the solution and the lower the temperature, the longer the time of gellation. The gel is then dried at 170 deg. F. to a 50% H_2O content, after which the gel is broken to chunks 3 to 4 in. in diameter. The chunks are then dropped into water and these disintegrate to pieces about the size of corn. These pieces then ground and screened. The sizes —8 and +40 mesh are used as intended for water softening by the pervious bed method or other suitable apparatus. The fines are rejected. *Eskel Nordell, assignor to Permutite Co.,* October 9, 1928. U. S. Patent No. 1,687,036.



Improved endless-belt machine for building up multi-layered cement asbestos board

Florida Stone Producer Contributes Material for Flood Relief

TEN CARLOADS of lime rock to be used in rebuilding roads in the storm swept region around Lake Okeechobee, Florida, have been donated to the citizens relief committee of Okeechobee City, according to C. S. Simmons, committee chairman, who left yesterday after making arrangements for the loan of two draglines from local construction companies.

The road material, Mr. Simmons said, has been given by the Ocala Lime Rock Corp., Ocala, and will be used on highways which were washed away or badly damaged during the hurricane.—*Tampa* (Fla.) *Tribune.*

Wisconsin Highway Department Contrives Way to Injure Gravel Producers?

UNIVERSITY OF WISCONSIN students of geology, working as prospecting parties, are being used to discover mines of suitable road building material and reduce the cost of new roads. The statement emanated from the state department of geology that operations of these student prospectors resulted in a saving of $30,000 in the building of 11 miles of concrete on Highway 12 north of Madison toward Baraboo. The students proceed along the route of the new road, make explorations, dig into the earth and take samples of material. They also send data as to quantity and location with respect to the distance from the job. The samples are tested in the office of the state geologist, E. F. Bean, and the value of the material for the purpose of road building is determined. Farmers along the road are paid for material used, the rate for that used on the Madison-Baraboo job being 5 cents per cubic yard.—*Milwaukee* (Wis.) *Journal.*

Less Fatal Accidents in British Quarries

THE ANNUAL REPORT of the British Inspector of Quarries has just been issued for 1927 and deals primarily with questions relating to the safety and health of workers in and about quarries. It also contains considerable information as to the number, scope and variety of the country's mineral workings. The chapters on accident and their prevention are, however, the main features of the report.

It is pointed out that during the period of a little more than 30 years for which statistics are available, the death rate from accidents "inside" the quarry has been reduced by one-fourth, while that of quarry workers is practically the same. The reduction "inside" the quarry—namely, from 1.57 deaths per 1000 persons employed in 1895-1904 to 1.18 in 1923-27—is primarily due to the decreased number of accidents from falls of ground—namely, from 0.73 to 0.55—namely, from 0.61 to 0.45.

It is not to the credit of those connected with quarries, the Chief Inspector comments, that in the period 1923-27, the death rate from accidents per 1,000 persons employed inside quarries was as great as it was below ground at coal mines, where the men work in narrow roadways and in dim, artificial light. These men are also liable to be killed by accidents from which quarry workers are immune, e. g., explosions of fire-damp and coal dust, and shaft accidents. If the deaths of miners from accidents due to these causes are deducted from the total, the frequency of deaths from accidents at quarries is no less than 8% higher than that of underground workers in collieries. Deaths due to blasting accidents are relatively only slightly less now than they were 32 years ago—namely, 0.16 during the period 1923-27, compared with 0.19 per 1,000 persons employed.

Fatal accidents caused during descent or ascent to or from work inside the quarry are of comparatively rare occurrence, and they are relatively fewer now than formerly. Falling from ledges is a frequent cause of accident among those which are grouped under the "miscellaneous" heading. Next in importance among the causes which are distinguishable are accidents occurring on railways or tramways inside the quarry. There is a small number of deaths annually caused by the breaking of ropes or chains and by the use of machinery, and on inclined and engine planes, but the causes previously particularized account roughly for one-half the fatalities in the "miscellaneous" group.

Alaska Governor Visits Pacific Coast Cement Co.'s Crushing Plant

THE PACIFIC COAST CEMENT CO. has built up a splendid plant at View Cove, Dall Island, Governor Parks said recently to a representative of the *Seattle* (Wash.) *Alaska Weekly.* He visited there and was shown through the works by Superintendent McDonald. Fifty-seven men are employed at the plant, which has a daily crushing capacity of 100 cars of limestone.

A large dock, storehouses and permanent camp buildings have been constructed. The rock is quarried about 100 ft. above the beach line, loaded into the cars by a Bucyrus steam shovel, and hauled to the jaw crusher. After being crushed it is conveyed on a belt to a glory hole for storage pending shipment. Other belt conveyors carry it direct from the storage to and into the ships.

The company has scheduled 36 trips of its own vessels for the next year. Each ship has a capacity of 6500 tons. The limestone is hauled to Seattle, where it is used in the manufacture of cement.

Oregon Rip-Rap Quarry Has Produced 300,000 Tons This Season

THE HAUSER CONSTRUCTION CO. quarry operations at South Coos river, near Marshfield, Ore., have been suspended until March 1 on account of the general storms retarding work at this time of the year. The jetty operations have partially ceased on account of the damage done to jetty construction by the constant heavy storms at this time of the year.

During the past year 300,000 tons of rock have been taken from the quarry and shipped by scows to the jetty works at Charleston.—*Marshfield* (Ore.) *Times.*

Sand and Gravel Plant Has Odd Sideline

THE ATHERTON SAND CO., Danville, Ill., having purchased a Beyers truck crane, is offering a complete excavating and crane service to Danville and other towns within a radius of 25 miles. The company will specialize in basement excavation and steel erection, using the crane for stripping and loading sand and gravel when not otherwise occupied. This service will be offered both on a contract and a flat rate basis.—*Danville* (Ill.) *News.*

National Slate Association's Convention at New York January 14-17

THE SEVENTH annual conference of the slate quarrying industry will take place at the Commodore hotel, New York City, January 14-17, 1929. Each year the slate industry conferences are looked forward to with great anticipation. There is a keen sense of expectation for some particular results, at least one outstanding accomplishment in the march of the industry toward its two-fold goal: Increased sale and use of its products and increased usefulness and service to the public, the second absolutely necessary to the fulfillment of the first. This year the stage seems set for concrete, tangible accomplishments, the fruition of many years' desires and recommendations voiced at conferences in previous years. The year 1928 has marked the definite organization and functioning of separate sales promotion associations for each district—for Bangor, Pen Argyl, Granville and Fair Haven. Four district roofing selling organizations which can function in a definite manner toward solving many of the problems that have had to go unsolved for many years. Also the Roofing Contractors Division is now well established, active, eager to serve and do its part to remedy the ills of the industry. Careful planning of activities and programs for 1929, the relation of the National Slate Association to them and the common job it can do for all will take time to do it well during the conferences.

Editorial Comment

Highway Concrete

The facts brought out by a study of 2200 cores from Maryland highways (see *Public Roads* for October) ought to interest producers as much as they do highway engineers. The most important fact is that the cores were of good concrete, averaging better than 4000 lb. in compression for a 1:2:4 mix. This speaks as well for the materials as for the engineering skill that combined them. Some of the roads were nine, ten and even eleven years old, but no certain deterioration from age could be detected, in spite of the many changes from hot to cold and from wet to dry the roads had undergone, not to speak of the impact of thousands of heavily loaded trucks and the sharper impacts of many thousands more of lighter cars and busses.

Eight different aggregates had been used in these roads, granite, trap rock, sandstone, slag, "mixed rock," (probably crushed gravel), ordinary gravel and quartz gravel, besides mixtures of two of these. One of the purposes of the investigation was to see if there were differences in strength due to the aggregates used. Differences were found, but these differences were less than differences found between cores drilled almost side by side from the same road slab.

And these last named differences were the basis of one of the most interesting parts of the investigation, that of uniformity. The cores were grouped by position in the road and the variation of each core from its group mean was plotted. The mean of these variations, called the modulus of variation, was about 8%. Groupings of carefully tested laboratory samples, as many as 5700 in one set, gave practically the same value to the modulus. Apparently this means that in any large number of samples we must expect to find a variation of 16% to 17% from the mean strength of the group. A grouping of steel tests showed that steel also has a modulus of variation which is 0.62%, meaning that steel samples should test within 1.24% of the average of the group. Actually in the steel group plotted some samples tested almost 5% higher or lower than the average, just as some of the cores tested 30% higher or lower than the average. But these are exceptional.

The review by Prof. Anderson, of Maryland University, suggests that the value of the modulus of variation depends upon the homogeniety of the substance tested. Steel, being very homogeneous, has a low modulus of variation while concrete, which from its very nature must always be much less homogeneous, has a high one. This is not a defect of concrete; it is a limitation; and it is one that concrete engineers have, perhaps unconsciously, recognized in designing. It is well to have it studied and allowed for in a scientific way.

A discussion of the study of elasticity made on 112 of these cores (given in *Public Roads* for October) lies outside of the rock products field. It is enough to say that the careful methods used showed these cores to be of a material that was of elastic behavior when loaded up to a limit that averaged between 700 lb. and 800 lb. The modulus of elasticity averaged 3,562,000 instead of the 2,000,000 lb. that is ascribed to 1:2:4 concrete by some books on structural design. Undoubtedly concrete is elastic. How otherwise could these roads have withstood the severe traffic and the seasonal changes?

Power from CO_2

It is generally conceded that one of the great losses in lime burning and cement making is in the production of CO_2 which has to be wasted. Attempts to use the dry ice made from it have so far met with only a limited success in competition with other methods of refrigeration. However, the possibilities in this direction have not been exhausted. In the most used present process the CO_2 is derived from burning coke. The cost of the CO_2 is such a minor item under present dry-ice manufacturing conditions, that the use of by-product CO_2 from lime and cement plants has not been much considered. But the possibilities of making pure CO_2 without dilution with atmosphereic nitrogen is one of the possibilities in such a byproduct CO_2.

Possibly some day an inventor will use dry ice economically to store power. There are about 79,000 ft. lb. of energy in each pound of it, not much compared with the energy in a pound of coal or a pint of gasoline, but it is in a form not without certain advantages. Used with a little heat (as compressed air was once used) it might form the basis of a very efficient motor. It might also be used to drive such portable machines as rock drills, where they were used away from electric power and compressed-air lines.

The only performance record of a CO_2 motor the writer has seen was that of a small one used in a model airplane. It was chosen because of its light weight for it weighed only 1¾ lb. and it developed 1 h.p. It was only a scientific toy of no practical value, but many scientific toys have developed into useful machines, even those which scientists have pronounced to be quite impractical.

In the future, the lime and cement industries must stand or fall, along with all others, on the elimination of waste products. The two major waste products of these industries are heat and CO_2. Ultimate failure to make use of these may very probably result in lime and cement themselves becoming useful "waste products," or byproducts, of some more enterprising industries.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. com.[37]	12-30-27	3	7	
Allentown P. C. 1st 6's[29]	12- 6-28	90	.....	
Alpha P. C. new com.	12- 3-28	49	51	75c qu. Oct. 15
Alpha P. C. pfd.[2]	12- 3-28	116	.....	
American Aggregates com.	12- 6-28	52	55	75c qu. Dec. 1
Amer. Aggregate 6's, bonds	12- 6-28	118	120	
American Brick Co.	12- 4-28	17	18	25c qu. Nov. 1
American Brick Co. pfd.	11-19-28	91	94	50c qu. Nov. 1
Am. L. & S. 1st 7's[29]	12- 6-28	100½	101½	
American Silica Corp. 6½'s	12- 5-28	96	100	
Arundel Corp. new com.	12- 5-28	43¾	44	50c qu. Oct. 1
Atlantic Gyp. Prod. (1st 6's & 10 sh. com.)[10]	12- 5-28	85	90	
Atlas P. C. com.	12- 3-28	48	50	50c qu. Dec. 1
Atlas P. C. pfd.	12- 3-28	46	.....	66⅔c qu. July 2
Beaver P. C. 1st 7's[30]	12- 4-28	98	100	
Bessemer L. & C. Class A[4]	12- 3-28	37	37¾	75c qu. Nov. 1
Bessemer L. & C. 1st 6½'s[4]	12- 3-28	100	100¾	
Bloomington Limestone 6's[29]	12- 6-28	93½	95	
Boston S. & G. com.[16]	11-30-28	77	81	$1 qu. July 2
Boston S. & G. 7% pfd.[16]	11-30-28	84	86	1¾% qu. July 2
Boston S. & G. Co. 1st pfd.[16]	11-30-28	94	96	2% qu. July 2
Canada Cem. com.[43]	12- 3-28	33½	34	
Canada Cement pfd.[43]	12- 3-28	96¾	99	1.62½ qu. Dec. 31
Canada Cement 5½'s	12- 1-28	101¼	102	
Canada Cr. St. Corp. 1st 6½'s	11-29-28	.....	96	
Canada Gyp. & Alabastine	12- 3-28	74½	75	75c Oct. 1
Certainteed Prod. com.	12- 4-28	28½	28⅞	$1 qu. Oct. 1
Certainteed Prod. pfd.	12- 3-28	82	90	1.75 qu. Jan. 1
Cleveland Stone new st'k	12- 5-28	70	77	50c qu. Dec. 1 & 25c ex.
Columbia S. & G. pfd.	12- 4-28	91½	92½	
Consol. Cement 1st 6½'s, A[42]	12- 5-28	93	96	
Consol. Cement 6½ notes	12- 5-28	92	96	
Consol. Cement pfd.[29]	12- 6-28	40	60	
Consol. S. & G. com. (Canada)	12- 3-28	17	18	
Consol. S. & G. pfd. (Canada)	12- 3-28	.....	90	1¾% qu. Nov. 15
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[18]	11-30-28	98	99½	
Coosa P. C. 1st 6's[29]	12- 5-28	50	55	
Coplay Cem. Mfg. 1st 6's[40]	12- 4-28	90	.....	
Coplay Cem. Mfg. com.[40]	12- 4-28	15	.....	
Coplay Cem. Mfg. pfd.[40]	12- 4-28	75	.....	
Dewey P. C. 6's[36]	12- 5-28	99	101	
Dolese & Shepard[7]	12- 5-28	125	130	$2 qu. Oct. 1; $1 ex. Oct. 1
Edison P. C. com.[19]	12- 4-28	50c	.....	
Edison P. C. pfd.[19]	12- 4-28	1	.....	
Edison P. C. bonds[19]	12- 4-28	75	.....	
Fredonia P. C. 1st 6½'s[22]	12-28-27	97	101	
Giant P. C. com.	12- 3-28	26	33	
Giant P. C. pfd.	12- 3-28	35	40	3½% Dec. 15
Ideal Cement, new com.	12- 3-28	87	89	75c Oct. 1
Ideal Cement 5's, 1943	12- 3-28	116½	118½	
Indiana Limestone 6's	12- 5-28	92	92½	
International Cem. com.	12- 4-28	83	83½	$1 qu. Dec. 28
International Cem. bonds 5's	12- 4-28	104¾	105⅜	Semi-ann. int. payable June 15
Iron City S. & G. bonds 6's[40]	12- 1-28	97	99	
Kelley Is. L. & T. new st'k	12- 5-28	55½	56¼	62½c qu. Oct. 1
Ky. Cons. Stone Co. com.[45]	11-30-28	13	15	
Ky. Cons. St. com. Voting Trust Certif.[45]	11-30-28	13	15	
Ky. Cons. Stone 6½'s[45]	11-30-28	96	100	
Ky. Cons. St. Trustee Certif.[45] (1 sh. 7% cum. pfd. & 1 sh. com. stock)	11-30-28	99½	102	1.75 Aug. 1
Keystone Sand & Sup. 6's[47]	8-22-28	99	100	
Lawrence P. C.[2]	12- 3-28	96	101	2% qu. Sept. 29
Lawrence P. C. 5½'s, 1942	11- 8-28	95	97	
Lehigh P. C.[2]	12- 4-28	54	54½	62½c qu. Feb. 1
Lehigh P. C. pfd.[2]	12- 4-28	108	108¾	1¾% qu. Jan. 1
Lyman-Richey 1st 6's, 1932[18]	12- 3-28	99	100	
Lyman-Richey 1st 6's, 1935[18]	12- 3-28	97	99	
Marblehead Lime 1st 7's[14]	12- 1-28	100	.....	
Marbleh'd Lime 5½'s, notes[14]	12- 1-28	98½	100	
Material Service Corp. 6's	11- 8-28	99	100	
Mich. L. & C. com.[6]	12- 4-28	40	.....	
Missouri P. C.	12- 3-28	45½	45¾	50c qu. Aug. 1
Monolith Midwest[9]	11-30-28	8	10	
Monolith P. C. com.[9]	11-30-28	13¾	14¼	8% ann. Jan. 2
Monolith P. C. pfd.[9]	11-30-28	9	9½	
Monolith P. C. units[9]	11-30-28	31¾	33¼	
National Cement 1st 7's[38]	12- 3-28	99	101	
National Gypsum A com.[35]	12- 4-28	17	20	
National Gypsum pfd.[35]	12- 4-28	53	56	1¾% qu. Apr. 1
Nazareth Cem. com.	12- 1-28	27	30	75c qu. Apr. 1
Nazareth Cem. pfd.	12- 1-28	100	.....	
Newaygo P. C.[1]	12-30-27	115	.....	
Newaygo P. C. 1st 6½'s[29]	12- 6-28	100	.....	
New Eng. Lime pfd., A[41]	10- 6-28	.....	90	
New Eng. Lime pfd., B	11-2-28	97	99	
New Eng. Lime com.	11- 2-28	25	30	
New Eng. Lime 1st 6's[14]	12- 1-28	98	100	
N. Y. Trap Rock 1st 6's	12- 5-28	100⅝	101	
North Amer. Cem. 1st 6½'s	12- 5-28	70	70	
North Amer. Cem. com.	12- 6-28	9	9½	
North Amer. Cem. 7% pfd.	11-22-28	21	26	1.75 qu. Aug. 1
North Amer. Cem. units	12- 6-28	25	32	
North Shore Mat. 1st 5's[15]	12- 5-28	98½	.....	
Northwestern States P. C.[37]	12- 1-28	197	208	
Pac. Coast Cem. 6's. A	11-30-28	96½	98½	
Pacific P. C. com.	12- 1-28	25	25⅝	
Pacific P. C. pfd.	12- 1-28	80	.....	1.62½ qu. Apr. 5
Pacific P. C. 6's	11-30-28	99	100½	
Peerless Egyp'n P. C. com.[21]	12- 1-28	2¼	2¾	
Peerless Egyp'n P. C. pfd.[21]	12- 1-28	80	85	1¾% qu. July 1
Penn-Dixie Cem. 1st 6's[39]	12- 4-28	95½	96	
Penn-Dixie Cem. pfd.[28]	12- 5-28	83	85	1.75 qu. Dec. 15
Penn-Dixie Cem. com.	12- 5-28	20	20⅜	50c qu. July 1
Penn. Glass Sand Corp. 1st 6's, 1952	11- 8-28	103	105	
Penn. Glass Sand pfd.	11- 8-28	110	.....	
Petoskey P. C.	12- 4-28	10	10¼	1½% qu.
Riverside P. C. com.	12- 1-28	20	.....	
Riverside P. C. 1st pfd.	12- 1-28	95	98½	1.50 Aug. 1
Riverside P. C., A	12- 1-28	18	.....	31¼c cum. part. Aug. 1
Riverside P. C., B	12- 1-28	1	2	
Rockland-Rockport Lime 1st pfd.[10]	5-17-28	.....	100	3½% s.-a. Feb. 1
Rockland-Rockport Lime 2nd pfd.[10]	5-17-28	.....	60	3% s.-a. Feb. 1
Rockland-Rockport Lime com.[10]		no market		1½% qu. Nov. 2
Sandusky Cem.	12- 5-28	240	250½	$2 qu. Jan. 1 & $4 extra
Santa Cruz P. C. bonds	12- 1-28	105¾	.....	6% annual
Santa Cruz P. C. com.	12- 1-28	92⅛	95	$1 qu. Oct. 1
Schumacher Wallboard com.	12- 1-28	16	17½	50c May 15
Schumacher Wallboard pfd.	12- 1-28	.....	25	
Southwestern P. C. units[44]	11-22-28	270	.....	
Superior P. C., A[20]	12- 1-28	47½	48	27½c mo. Dec. 1
Superior P. C., B[20]	12- 1-28	42½	43½	
Trinity P. C. units[37]	12- 1-28	155	165	
Trinity P. C. com.[37]	12- 1-28	52½	.....	
U. S. Gypsum com.	12- 5-28	68	69	2% qu. Dec. 31
U. S. Gypsum pt. paid	12- 5-28	50½	51	
U. S. Gypsum pfd.	12- 5-28	125	.....	1¾% qu. Dec. 31
Universal G. & L. com.[3]	12- 5-28	50c	1	
Universal G. & L. pfd.[3]	12- 5-28	5	10	1½% Feb. 15
Universal G. & L., V.T.C.	12- 5-28	no market		
Universal G. & L. 1st 6's[3]	12- 5-28	50	60	
Chas. Warner com.	12- 3-28	41	43	50c qu. Oct. 10 & 25c ex.
Chas. Warner pfd.	12- 3-28	109	.....	1¾% qu. Oct. 25
Whitehall Cem. Mfg. com.[26]	12- 1-28	.....	50	
Whitehall Cem. Mfg. pfd.[26]	12- 1-28	.....	50	
Wisconsin L. & C. 1st 6's[15]	12- 5-28	100	.....	
Wolverine P. C. com.	12- 4-28	6	7	15c qu. Nov. 15
Yosemite P. C., A com.[29]	12- 1-28	4¾	5¼	

[1]Quotations by Watling, Lerchen & Hayes Co., Detroit, Mich. [2]Quotations by Bristol & Willet, New York. [3]Quotations by Rogers, Tracy Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman. Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee Higginson & Co., Boston and Chicago. [11]Nesbit, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hoit, Rose & Troster, New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., Detroit. [22]Pirnie, Simons and Co., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [31]McIntyre & Co., New York, N. Y. [32]Hepburn & Co., New York. [33]Boettcher & Co., Denver, Colo. [34]Kidder, Peabody & Co., Boston, Mass. [35]Farnum, Winter and Co., Chicago. [36]Hanson and Hanson, New York. [37]S. F. Holzinger & Co., Milwaukee, Wis. [38]McFetrick and Co., Montreal, Que. [39]Tobey and Kirk, New York. [40]Steiner, Rouse and Stroock, New York. [41]Hornblower & Weeks, New York City and Chicago. [42]E. H. Rollins, Chicago, Ill. [43]Jones, Heward & Co., Montreal, Que. [44]Tenney Williams & Co., Inc., Los Angeles, Calif. [45]Stein Bros. & Boyce, Baltimore, Md. [47] Bank of Pittsburgh, Pittsburgh, Pa. [48]E. W. Hays & Co., Louisville, Ky.

INACTIVE ROCK PRODUCTS SECURITIES (Latest Available Quotations)

Stock	Price bid	Price asked
American Brick Co. pref. (sand-lime brick) 16 sh.[6]	par 25	25¾
Benedict Stone Corp. (cast-stone), 50 pfd., 390 com.[1]	$400 for the lot	.....
Benedict Stone Corp. 1st 7's 1934[8]	.....	86
International Portland Cement Co., Ltd., pfd.	30	45
Knickerbocker Lime Co.[4]	105	.....
River Road Sand and Gravel Co.,[9] 200 shares	$21 per share	
River Road Sand and Gravel Co.,[11] 219 shares	$55 per share	
Simbroco Stone Co.,[10] 10 sh. pfd., par $50	$10.25 per sh.	
Southern Phosphate Co.[5]	1¼	.....
Vermont Milling Products Co. (slate granules), 22 sh. com. and 12 sh. pfd.[6]	$1 for the lot	.....
Winchester Brick Co., pfd., sand lime brick[5]	10c	.....

[1]Price obtained at auction by Adrian H. Muller & Sons, New York. [2]Price obtained at auction by Weilupp-Bruton and Co., Baltimore, Md. [4]Price obtained at auction by Barnes and Lofland, Philadelphia, on April 4, 1928. [5]Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. [6]Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass. [8]Auction sales of $1000, Barnes & Lofland, Philadelphia, March 31, 1928. [9]Price obtained at auction by Barnes & Lofland, Sept. 26, 1928. [10]Price at auction, June 6, 1928, R. L. Day & Co., Boston, Mass. [11]Price at auction, Nov. 21, 1928, by Barnes & Lofland.

Sandusky Cement Pays Extra Dividend and Changes Its Name

THE Sandusky Portland Cement Co., Cleveland, Ohio, is declaring $4 extra dividend in cash. Directors also voted to change the name of the company to the Medusa Portland Cement Co. and to increase the capital. The new name is taken from the brand of cement the company handles and supplants the name Sandusky since the company now has plants in Dixon, Ill., Silica, Ohio, and York, Penn., in addition to the original plant at Bay Bridge, near Sandusky, Ohio.

In addition to voting the regular quarterly dividend at $2 a share, the directors voted an extra $4 cash both payable January 1 to stockholders of record December 25, making $12 for the year. They also recommended that the authorized capital be increased from 75,000 shares no par to 225,000 shares. If this is approved by stockholders December 20 it is proposed to split the shares two for one, April 2, to holders of record April 1, 1929. There are 73,464 shares outstanding so that this distribution will increase the total to 146,928.

The Sandusky Cement Co. has built two plants in York, Penn., since July last year without recourse to special financing. In one the company manufactures white cement and in the more recent one gray cement. This brings up total production capacity to 15,000 bbl. a day.—*Cleveland* (Ohio) *Plain Dealer.*

Certain-teed Products Corp. Balance Sheet

BECAUSE of its extensive interests in the gypsum products industry the following extracts from the semi-annual report of the president of the Certain-teed Products Corp., George W. Brown, are of interest to rock products manufacturers (the report covers the first six months of 1928):

"The general balance sheet shows the company to be in excellent financial condition with a ratio of quick assets to quick liabilities of 6.03 to 1. The units of sales of Certain-teed products, including Beaver products, for the first half of the current year were very satisfactory, being at high water mark on most of the important items for these same properties for any first half-year period. Our recent charges for depreciation, depletion and repairs have been at the annual rate of $2,656,000, about one-half of this amount being for repairs. We have succeeded in making economies at the rate of $2,000,000 per year by combining the operation of Certain-teed company and the Beaver companies. We believe that no real impairment of efficiency will result from these economies.

"The varying standards of goods, with the varied policies used by different manufacturers, has led to some keenly competitive prices during the period covered by this report, which adversely affected our net earnings. Price reductions were, in some cases, so great that the goods were sold without profit, although our ability to manufacture and distribute goods in our lines, we believe, is unsurpassed. We have protected our trade by meeting competition freely.

"During the period covered by this report our roofing division prices dropped to a very low level. The decline from the prices of last year for that division, based on last year's volume, amounted to well over one and a half times our present entire annual dividend requirements on both the preferred and common stocks. Roofing division prices have been restored to the basis of last year, so our second half-year earnings from that source should benefit in like measure. The present selling prices in some of our other divisions, which are too low for normal profits, should show good increases when sound business methods are adopted. Sufficiently competitive selling, when used long enough, generally leads to the adoption of standardized practices, just as a successful operation permits the enjoyment of good health.

"During the six months' period we drew on our earned surplus for a large portion of our dividends because of our belief that such competitive conditions would not continue for a prolonged period and that upon their termination the surplus would be rapidly restored, as our company, at normal prices for its goods and with its large volume, can make substantially net earnings."

BALANCE SHEET OF THE CERTAIN-TEED PRODUCTS CORP., AS OF JUNE 30, 1928

ASSETS

	1928	1927
Land, buildings, machinery, etc.	*$26,966,237	$18,177,765
Good will, trade marks, patents, etc.	1	1
Cash	2,113,234	1,051,712
Notes receivable	361,257	217,795
Miscellaneous claims and accounts	118,371	.....
Salesmen's advertising and sundries	35,854	.....
Deposited for redemption of old preferred stock	177,910	.....
Accounts receivable	5,234,794	3,766,238
Inventories	7,026,480	5,136,860
Invested in other companies	606,436	9,333
Other investments	413,650	.....
Expenses paid in advance	376,814	264,254
Total	$43,431,039	$28,623,957

LIABILITIES

	1928	1927
7% cumulative preferred stock	$6,290,390	.....
First preferred 7% stock	.....	$4,120,000
Second preferred 7% stock	.....	2,675,000
Common stock	†17,370,000	12,720,000
Notes payable	.....	1,400,000
Accounts payable	1,380,694	779,782
Old preferred stock not redeemed	177,910	.....
Debenture bonds	13,500,000	.....
Mortgage bonds of subsidiaries	262,500	.....
Minority stock interest	118,700	.....
Miscellaneous reserves	70,859	.....
Accrued bond interest	251,708	.....
Dividends payable	508,502	425,913
Accrued local and federal Reserve for federal taxes	22,488	176,700
taxes	329,665	182,104
Surplus‡	3,147,621	6,144,458
Total	$43,431,814	$28,623,957

*Land, buildings, machinery and equipment at manufacturing plants, warehouses and offices at sound value as determined by appraisal, plus subsequent expenditures at cost, less reserve for depreciation of $11,461,008, $21,819,211; water power rights at Marseilles, Ill., at appraisal value, less $17,895 for amortization, $651,784; gypsum deposits at appraisal, plus subsequent expenditures at cost, less reserve of $426,951 for depletion, $4,495,242; total, $26,966,237. †Common stock, 400,000 shares of no par value, at value declared under laws of Maryland or at issue price. ‡Includes capital surplus of $1,435,814 and earned surplus of $1,711,807.

Lehigh Portland Cement

IN SOME CIRCLES it is felt that because of its position in the industry in which it operates, much higher prices are warranted for Lehigh Portland Cement. Prospects of earnings in the current quarter are for better than $2 a share. In addition to this, Lehigh is in strong financial position. It will profit further from industrial improvement, further tariff relief, and the tendency on the part of cement makers to eliminate wasteful competition which has been so long prevalent in the industry.—*Wall Street News* (New York City).

Recent Dividends Announced

Canada Cement pfd. (quar.) $1.62½, Dec. 31
Certainteed Products pfd. (quar.) $1.75, Jan. 1
Giant Portland Cement pfd. 3½%, Dec. 15
International Cement com. (quar.) $1, Dec. 28
Kentucky Rock Asphalt pfd. (quar.) 1¾%, Dec. 1
Sandusky Cement (quar.) $2, Jan. 1
Sandusky Cement (extra) $4, Jan. 1
Virginia-Carolina Chemical prior pfd. (quar.) 1¾%, Dec. 1

Basalt 7s Called for Redemption

BASALT ROCK CO.'S first mortgage 7s of 1933 were called for redemption on December 1 at 101.

EARNINGS OF CERTAIN-TEED PRODUCTS CORP. FOR FIRST SIX MONTHS OF 1928-1925

	1928	1927	1926	1925
Gross profit after repairs, maintenance and depreciation	$2,251,956	$3,092,888	$3,069,678	$3,057,198
Other income	70,717	21,790	12,336	8,608
Gross income	$2,322,673	$3,114,679	$3,082,014	$3,065,806
Selling, administration, general expenses, expenditures and bank interest	2,050,511	1,804,725	1,785,868	1,657,210
Interest on bonds	220,770	.....	.....	262,548
Federal taxes	13,330	176,700	173,000	138,500
Sundry adjustments (net)	*2,504	7,680	2,725	*680
Net income	$40,567	$1,125,573	$1,120,420	$1,008,228
Preferred dividends (new)	107,627	.....	.....	.....
First preferred dividends	127,352	144,200	150,500	160,300
Second preferred dividends	.....	93,625	93,625	93,625
Common dividends	707,000	614,000	614,000	132,000
Balance surplus	†$901,412	$ 273,748	$ 262,295	$ 622,303
Shares of common outstanding (no par)	400,000	307,000	307,000	132,000
Earnings per share on common	Nil	$2.89	$2.84	$7.64

*Credit. †Deficit.

Monolith Midwest Plant Near Completion

CONSTRUCTION of the new $2,000,000 cement mill of the Monolith Portland Midwest Co. at Laramie, Wyo., is being rushed to completion under the personal supervision of W. S. Trueblood, production manager.

A crew of 125 men has been at work in the construction of the plant for more than a year. Latest reports indicate that the plant will be ready for opening shortly, starting operations with a capacity of from 1,800 to 2,200 bbl. of cement daily.

Approximately 115,000 sacks of cement, manufactured at Monolith, Calif., have been used to date in the construction of the Laramie plant.

The new cement mill, which was designed and erected by F. L. Smidth and Co., cement plant engineers of New York, will have an annual production of between 500,000 and 600,000 bbl.—*Denver* (Colo.) *News.*

Knoxville, Tenn., Imports Belgium Cement

A STRIKING ILLUSTRATION of the inroads being made by imported cement is contained in a news item from Knoxville, Tenn., the home of the new Volunteer Portland Cement Co. The item is as follows:

"John R. Hough returned November 13 from Antwerp, Belgium, and announced the purchase there of 200,000 sacks of cement and two million first grade pressed bricks.

"Mr. Hough announced that he would open a brokerage to be known as the Hough Brokerage Co. at 14 Plaza block. He said that the cement is already en route to Knoxville, coming by way of Tampa, Fla.

"Plans for an apartment house on McCalla avenue were also announced by Mr. Hough. He will start construction of this building about January 1.

"Mr. Hough said he sold 1,000,000 ft. of lumber in Antwerp. He is a native of Miami, but has lived in Knoxville for some time."

City Engineer Gets into Gravel Business

ARTICLES OF INCORPORATION for a new $50,000 sand and gravel company were filed in the county clerk's office at Pine Bluff, Ark., recently. Officers will be Marvyn Jones and Frank R. Allen of Pine Bluff and R. W. Crimm of Arkansas City.

Mr. Allen recently tendered his resignation to the city council of Pine Bluff as city engineer, the resignation to take effect on December 1. The corporation he has affiliated himself with has already issued 500 shares of common stock at par value of $100.—*Pine Bluff* (Ark.) *Graphic.*

Congress to Be Asked for Cement Tariff

FRANK H. SMITH, president of the Lawrence Portland Cement Co., New York, who was elected president of the Portland Cement Association, in his address of acceptance, urged the necessity of voluntary curtailment of production in industries largely overbuilt and advocated a protective tariff for cement.

At the close of the recent meeting of the association, a resolution was unanimously adopted calling upon the ways and means

Frank H. Smith

committee of the House of Representatives and the finance committee of the Senate to undertake an immediate examination, in the next Congress, into conditions which justify a duty on cement. The threat to American standards of living of the imported product, produced under a wage scale many times lower than in America was emphasized in the resolution.

The complete text of the resolution, which was passed unanimously, follows:

"Whereas, both political parties in effect stated in their campaign platforms and public announcements that they would examine and where necessary revise schedules covering certain industries which cannot now successfully compete with foreign producers because of lower foreign wages and a lower cost of living abroad, which characterization describes the cement industry, and

"Whereas, the next Congress will meet in extraordinary session in the spring of next year,

"Be it resolved, that the Portland Cement Association in annual convention assembled, urges that the Ways and Means Committee of the House of Representatives and the Finance Committee of the Senate undertake immediately to examine into conditions which justify a duty on cement, now on the free list, in order that American cement may be protected from competition by foreign cement produced under a wage scale which American standards of living forbid and transported to the American seaboard at lower freight rates than domestic producers must pay to reach the same markets.

"Be it further resolved, that the cement industry seek the active support of members of Congress to obtain a tariff duty on cement at the earliest session of the next Congress."

Walter S. Wing, General Sales Manager of Penn-Dixie

THE PENNSYLVANIA-DIXIE CEMENT CORP., New York City, announces the appointment of Walter S. Wing as general sales manager effective November 15, 1928. In his new position Mr. Wing will be in general charge of the marketing of the corporation's products and will be located at 131 East 46th St., New York City.

Mr. Wing graduated from Cornell University with the degree of mechanical engineer in 1907, and in that summer entered the steel business in Pittsburgh, obtaining employment with a subsidiary of the United States Steel Corp. About 1908 he was transferred to another subsidiary, the Universal Portland Cement Co., by which company he has been employed until very recently. The last 13 years he served the Universal company as eastern sales manager with his office in Pittsburgh.

Mr. Wing has always been interested in public and civic affairs and was an active member of the United States Chamber of Commerce, Pennsylvania State Chamber of Commerce, Ohio State Chamber of Commerce, Pittsburgh Chamber of Commerce, and Civic Club of Allegheny County. He is also a member of the American Society for Testing Materials, Cornell Society of Engineers, and in Pittsburgh he is a member of the Duquesne Club, University Club, Longue Vue Club, Railway Club of Pittsburgh, Automobile Clubs of Pittsburgh, Pittsburgh Builders Exchange and others.

Canada Cement to Build Distributing Depot at Quebec

ANNOUNCEMENT is made that the Canada Cement Co., Montreal, Que., will expend in the neighborhood of $1,000,000 for the construction of a distribution depot in Quebec. The first step in the development was taken with the purchase of properties located in the Lower Town. The company, it is said, will also construct a special wharf on the St. Charles river.

Census of Cement Manufacturers, 1927

THE DEPARTMENT OF COMMERCE announces that, according to data collected at the biennial census of manufacturers taken in 1928, the establishments engaged primarily in the manufacture of cement in 1927 reported products valued at $293,565,293, a decrease of 2.4% as compared with $300,895,070 for 1925, the last preceding census year. The total output comprised 173,206,513 bbl. of portland cement, valued at $287,431,268; 2,123,868 bbl. of natural and puzzolan cements, valued at $3,126,211, and miscellaneous products, such as ground stone and shale, paving dust, asphalt filler and clinkers, valued at $3,007,814.

This industry consists in the manufacture of hydraulic cement from rock, usually quarried by the same establishments. The principal product is portland cement, but small quantities of natural and puzzolan cements are also manufactured. Portland cement is a calcined and ground mixture of limestone, chalk or marl, and clay or shale. Natural cement is an argillaceous limestone, calcined and ground. Puzzolan cement is made by grinding a mixture of furnace slag and slaked lime. The cement industry as constituted for census purposes does not include the manufacture of refractory cement, which is made by establishments classified in the "clay products (other than pottery) and nonclay refractories" industry.

Of the 161 establishments reporting for 1927, 25 were located in Pennsylvania, 15 in Michigan, 13 in New York, 12 in California, 11 in Ohio, 8 in Kansas, 7 in Alabama, 7 in Texas, 5 each in Illinois, Indiana, Iowa, Missouri and Tennessee, 4 in Washington, 3 each in Colorado, Georgia, Minnesota, Oregon, Utah and West Virginia, 2 each in Maryland, Montana, New Jersey, Oklahoma and Virginia, and 1 each in Florida, Kentucky, Louisiana, Nebraska, South Dakota and Wisconsin.

The statistics for 1927 and 1925 are summarized in the following table. The figures for 1927 are preliminary and subject to such correction as may be found necessary after further examination of the returns.

	1927	1925	Per cent of incr. or decr. (—)
Number of establishments	161	145	11.0
Wage earners (average number)*	36,292	38,437	—5.6
Wages†	$ 53,219,678	$ 53,911,519	—1.3
Cost of materials, supplies, fuel and purchased power, total†	$119,808,989	$114,168,969	4.9
Material and supplies§	$ 59,345,728	‡	.....
Fuel and power	$ 60,463,261	‡	.....
Products:			
Total value†	$293,565,293	$300,895,070	—2.4
Portland cement—			
Barrels	173,206,513	161,658,901	7.1
Value¶	$287,431,268	$293,964,730	—2.2
Natural and puzzolan cements—			
Barrels	2,123,868	1,729,343	22.8
Value¶	$ 3,126,211	$ 2,709,030	15.4
Products other than cement, value	$ 3,007,814	$ 4,221,310	—28.7
Value added by manufacture‖	$173,756,304	$186,726,101	—6.9
Horsepower	1,057,898	871,650	21.4

*Not including salaried employes.

†The amount of manufacturers' profits cannot be calculated from the census figures, for the reason that no data are collected in regard to a number of items of expense, such as interest on investment, rent, depreciation, taxes, insurance, and advertising.

‡Not reported separately.

§Includes the cost of nonreturnable containers and the net loss on returnable containers.

¶Includes the value of nonreturnable containers sold with the product, but not that of returnable containers.

‖Value of products less cost of materials, supplies, fuel, and purchased power.

Plan to Pump Crushed Limestone More Than Two Miles

SEVERAL ATTEMPTS to build a cement plant in the Santa Monica Mountains, near Los Angeles, Calif., have met with strong enough opposition to prevent its construction. The locality, which is in Santa Ynez canyon, not far from the fashionable Beverly Boulevard, is one of the few places where limestone suitable for cement making is to be found near the city. It appears that the promotors now wish to quarry the rock and then transport it to a site on Los Angeles harbor where industrial plants are welcome. The scheme included pumping the crushed limestone, with the aid of gravity, two miles to Santa Monica Bay and then 1800 ft. further to a loading dock for barges.

This transpired at a recent meeting of the Los Angeles City Council, according to the report in the *Los Angeles Times*. One of the members of the council called its attention to the application which had been made to the U. S. War Department for permission to lay the pipe line and build the loading dock in Santa Monica bay. He was opposed to the plan as he said that the quarry and crushing plant would be just as objectionable to the residents of the district as the full plant originally proposed.

He introduced a resolution asking the War Department to refuse the permit and asking the council to zone the property to conserve its residential character. No action could be taken as there was no application before the council, but copies of the resolution were sent to the War Department and the City Planning Commission.

Changes in Universal Cement Personnel

NEW APPOINTMENTS by the Universal Portland Cement Co., Chicago, Ill., a subsidiary of the United States Steel Corporation, were announced recently by F. L. Stone, general sales manager of the company, as follows: R. H. Hoy, former division sales manager, sales manager, Pittsburgh; N. A. Kelly, former division sales manager, sales manager, New York; J. K. Hallock, former division sales manager, assistant sales manager, Pittsburgh; F. A. Brine, division sales manager, Pittsburgh, succeeding R. H. Hoy; W. H. McDowell, former sales agent, Cleveland, division sales manager, Pittsburgh.

"All the new appointees have been with the Universal company many years," Mr. Stone said. "Their long experience and familiarity with the work assure a continuance of the standards and service for which the company is known."

Southern Fertilizer Convention

THE fourth annual southern convention of the National Fertilizer Association was held at Atlanta, Ga., November 12-14, 1928, with headquarters at the Atlanta-Biltmore hotel.

It was a three-day, four-session program, during which many addresses were made, and the discussions were of great importance and interest to the entire fertilizer industry.

The importance of the meeting is shown when taking into consideration the fact that 263 persons were registered.

The outstanding theme of the convention was the observance of the code of trade practices, for as President Robins said in his opening address, that "the code was the most important matter before the fertilizer industry today."

During the meeting all signatories to the code on a roll call vote reaffirmed their faith in the business principles of their code and requested Executive Secretary Brand to ask the Federal Trade Commission for a trade-practice conference. This was made in the form of a resolution.

The much-discussed Muscle Shoals situation was given considerable thought and a constructive program was formulated in the interest of the fertilizer industry, which was made in the form of resolutions, which were unanimously adopted.—*The American Fertilizer.*

The concrete-and-steel sand plant of the Rhodes-Jamieson Co. at Eliot in the Livermore valley, in California. This is a pumping operation

Sand and Gravel Plants of the Livermore Valley, California

Growth of Gravel Production Is Rapid as the Plants Find a Ready Market in the San Francisco Metropolitan Area

By James N. Hatch
Pasadena, Calif.

LIVERMORE VALLEY, CALIFORNIA, besides being famous as a rich agricultural district producing a great variety of fruits and cereals, has of late years developed into a very large producer of sand and gravel. Along the Arroyo del Valle, between Livermore and Pleasanton, a distance of about four miles are to be found five large sand and gravel producing plants turning out concrete aggregates of an exceptionally high quality.

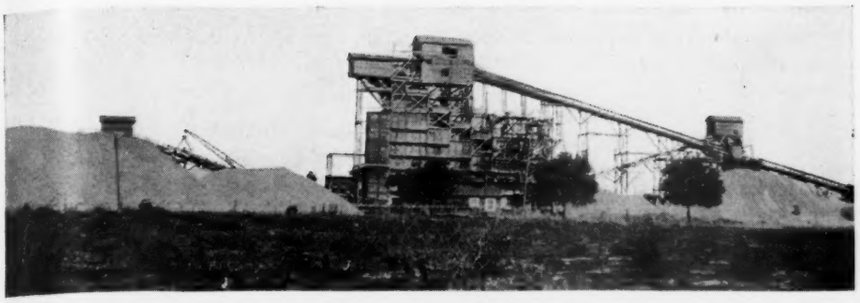
The Arroyo del Valle, while at present a dry river bed, has evidently in remote geologic times been a very wide and deep river, the bed of which was later filled with a glacial deposit of excellent sand and gravel. This old river bed is a mile or more wide in places and contains a deposit of gravel of an unknown depth.

Five Plants in Steady Operation

In the western part of the town of Livermore is located the plant of the Kaiser Paving Co. This is a large producing plant carrying a very large ground storage of material for road making and concrete. Further down the river toward Pleasanton is located the plant of the Coast Rock and Gravel Co., known as their Eliot plant. This plant produces and ships about 900 cars of material per month. Almost opposite the Coast Rock and Gravel Co. plant is the plant of the Rhodes-Jamieson Co. of Oakland. A little farther down the Arroyo is the plant of the California Rock Co. with a modern plant with a large production. Near Pleasanton is located the plant of the G. and M. Concrete Materials Co., which, while it is not so large a producer as the others, is a very busy plant.

The pit of the Coast Rock and Gravel Co., at Eliot, was formerly operated by dragline, but this has recently been discontinued and an electric power shovel substituted. At the same time a new system of belt conveyors was installed.

From the five plants there is shipped out each night two train loads of rock, sand and gravel, most of which goes to Oakland and San Francisco. It is estimated that the output from this valley this year will be no less



A view of the plant and large ground storage of the California Rock Co. near Pleasanton

than 20,000 carloads, and probably 10% as much more is taken to nearby customers in trucks. Livermore Valley is destined to be one of the great centers of production for this class of material. Being only 20 miles from the East Bay region, the output from this valley feeds into the distributing yards and bunker systems that are being developed to such a high efficiency in Oakland and Alameda and has the whole bay district for a market.

American Capital Interested in Proposed Canadian Trap Rock Plant

DETROIT and Buffalo capital, led by Perry E. Haworth of the Dominion Trap Rock Co. of Bruce Mines, Ont., will develop the trap rock deposits of the Garden River Reserve in Canada, according to an announcement made recently by Indian Agent Gordon Sims.

A million-dollar plant, covering several acres, will be erected on the St. Mary's river, three-quarters of a mile from the quarries, and the company will construct a fleet of shallow-draft vessels to ship the product. The agreement has been approved by the Garden River Indians and the Canadian Department of Indian Affairs at Ottawa. A royalty on the output of the concern will go to the capital account of the Garden River Reserve. According to the agreement, the plant must be ready for operation on December 1, 1929, and it must employ 100 men, 200 being engaged in construction work. The daily output of the plant is to be 5000 tons.

The company agrees to provide electric lighting for the village, and arrangements to that end are now being made with the Great Lakes Power Co. Spur lines are to be built from the river three-quarters of a mile to the quarry.

The deposit is located just east of the Garden River Reserve, at what is known as Wild Man's Bluff, and has never been operated before, though a limited amount of trap rock has been taken from it for local roads. The product is very high-grade, and said to be the best of its kind in the district of Algoma.

Ohio Sand and Gravel Plant Burns

THE NEW PLANT of the Wapakoneta Sand and Gravel Co., Wapakoneta, Ohio, owned by the Lewis and Copeland Construction Co., of Lima, was almost completely destroyed by fire November 20. Firemen fought the flames, which were discovered at 7 p. m., for nearly three hours before getting them under control.

The large concrete bins of the plant are all that remain, firemen having concentrated on saving that structure after seeing the remainder of the equipment was beyond saving.

The fire is believed to have started from a small heating stove in the building. The blaze was discovered soon after it had started but had gained great headway before firemen were able to lay hose.—*Lima* (Ohio) *News.*

Two More Industries Plan Trade Conferences

THE FEDERAL TRADE COMMISSION, it was announced November 29, has set Wednesday, December 12, as the time and Chicago as the place for the trade practice conference of the woodworking machinery industry. The meeting probably will last several days. The full test of the Commission's statement follows:

A majority of manufacturers and dealers will be represented. Among trade practices proposed for discussion are the inducing of breach of contract, fraud and misrepresentation, secret rebates, and price discrimination. Efforts will be made to provide for elimination of unfair commercial practices. Commissioner G. S. Ferguson, Jr., will preside.

Although the scope of this conference includes manufacturers and dealers, it is the desire of the industry and of the commission that all who have an interest in the subject consider themselves invited to attend, whether or not they receive an official announcement.

Dealers in supplies for barber and beauty shops also will hold a trade practice conference under auspices of the Federal Trade Commission, December 14, in Chicago. Commissioner G. S. Ferguson, Jr., will preside. The delegates will probably consider such trade practices as the inducing of breach of contract, secret rebates, distribution of price lists, misbranding, fraud and misrepresentation and price discrimination. Resolutions will be adopted with a view to eliminating unfair commercial practices.

Van Loan Whitehead

VAN LOAN WHITEHEAD, chairman of the board of directors of the Whitehead Bros. Co. of Providence, R. I., died on November 10, following an automobile accident. On November 9, he had been run down by an automobile in Buffalo, N. Y., and succumbed to his injuries on the following day. Mr. Whitehead had been for years associated with the Whitehead company which produces foundry sands and also foundry supplies and equipment. He was born on July 17, 1857.

Plant of the Coast Rock and Gravel Co. in the Livermore valley, which was recently changed to a shovel operation

The plant of the G. and M. Concrete Materials Co. near Pleasanton in the Livermore valley

President of Mathieson Alkali Becomes International Cement Director

AN ITEM of news from New York, announced December 4, may or may not be of special significance to the portland cement industry. The news is the election of E. M. Allen, president of the Mathieson Alkali Works, to membership on the board of directors of the International Cement Corp. The plan of the Mathieson Alkali Works to build a portland cement plant as a part of their operations at Saltville, Va., was officially announced nearly a year ago.

City Crushing Plant Claims Profit—But Look at the Prices!

THE CITY ROCK CRUSHER (Durham, N. C.) turns out an immense amount of rock and brings in a large amount of money, figures on the year's work show. A compilation by Z. A. Rochelle, city auditor, shows that for the year ending May 31, 1928, the plant produced 52,960.55 tons of rock, 3,005.21 yd. of dust, and 4,111.31 yd. of special, with a total, including the dust and special, of 62,249.36 tons of rock.

The total income from the crusher, which includes sales on scrap iron and other miscellaneous items, rock dust and specials, was $130,049.40. The total cost for the year for operating the crusher was $106,654.02, leaving a total profit at the close of the year of $23,395.38.

The gross income per ton for 62,249.36 tons of rock was an average of $2.089 per ton. The average cost of producing this amount was $1.7133 per ton or a gross profit of 27.57 cents per ton. The cost of operating the crusher does not include the depreciation costs or interest on the investment for the plant.—*Durham* (N. C.) *Morning Herald.*

Canadian Cement Manufacturers Continue Opposition to Tariff Removal

AT A HEARING in Ottawa, Ont., November 20, before the Canadian advisory board on tariff and taxation, Prof. Gilbert E. Jackson of Toronto University again entered the lists for the cement makers and Mr. Long answered a series of questions put at the last hearing by Mr. Darby.

Prof. Jackson supplying information sought by the National Council of Agriculture said the saving to be effected to Ontario consumers if the duty were removed would be $85,000. The calculated saving to western users is $13,000, that the total saving to certain users is placed at $100,000, the saving would be less than one seventh of the wages and salaries paid by Canadian cement mills in the district.

On the other hand, however, according to the statement of Prof. Jackson, "the loss to the other consumers is impossible of calculation. The narrowing of the market for domestic cement inevitably would raise expenses of production, and so cause an advance of cement prices in Canada. How great an advance it would cause is conjectural.

"Since higher prices in themselves would lead to the curtailment of purchasing, even in that part of the market which is not exposed to competition from abroad, and so further increase expenses of production, it is impossible to reckon in advance either the probable cost to the Canadian public of the removal of the duties, or the probable cost to the companies concerned.

"Without attempting to place a definite figure on their own anticipated losses, the cement producers nevertheless would repeat that if this application is successful some five-sixths of the people of Canada would be penalized for the sake of the remaining one-sixth whose proximity to the border would enable them to make some slight saving.

"Comparison of the freight rates from Canadian and United States mills to border points in the United States shows that in only one local market, and that a small one, would Canadian mills benefit under the reciprocal provisions of the United States tariff law, following the removal of the Canadian cement duty."

An appended table showed that the above changes would operate to the benefit of the United States mills in six cases, and to the benefit of only one Canadian mill.

"We would add," continued Prof. Jackson, "that since United States tariff legislation is capable of amendment in any session of Congress, we would place very little faith in the permanence, even of the small advantage at present offered in the case of Ogdensburg, N. Y."

Western mills have an operating expense 38% greater than eastern mills in Canada, Prof. Jackson continued, apportioned as follows: labor and liability, 5.6%; gypsum, 1.6%; other operating and repair materials, 17.7%; fuel, 6.5%; power and light, 5.4%; other insurance and taxes, 1.1%.

Duty and sales tax on machinery, etc., used in cement making in Canada total 26.17% for leather belting; 31.32% on rubber belting; 2.5 cents per lb. on explosives; 20% on lubricating oils; 31.32% on crushing machinery; 50 cents per ton on coal; 20% on hardware and electrical material.

"It is because of these heavy handicaps we plead continued necessity for an import duty," argued Prof. Jackson.

As to relative storage facilities on each side, as competing border points, Prof. Jackson said United States mills, by reason of steadier consumption, need storage capacity less than Canada's by 33%, giving United States mills a distinct advantage. Canadian mills, with production capacity of 12,900,000 bbl., have storage of 3,975,000 bbl. United States mills with production of 18,160,000 bbl. have storage for 3,863,000 bbl.—*Toronto* (Ont.) *Star.*

Colorado Marble Operation Sold to Eastern Interests

TITLE TO THE PROPERTIES of the Colorado Consolidated Yule Marble Co., near Marble, Colo., has passed to Jacob F. Smith, Buffalo, N. Y., president of the Vermont Marble Co., and Mr. Smith has disposed of a half interest in the Colorado concern to the Vermont Marble Co., according to an announcement in Buffalo, recently.

The transaction consummates a deal which had its inception last January when Mr. Smith agreed to purchase the Colorado marble properties. The consideration was not made public.

Acquisition of the Colorado properties by Mr. Smith and the Vermont Marble Co. is believed to foreshadow speedy and full development of them. The new owners are financially able to operate the quarries at capacity.

Besides the Consolidated holdings, Mr. Smith is the owner of a controlling interest in the Colorado Marble Co., a property adjoining.—*Denver* (Colo.) *Post.*

Canada Cement's Output for 1928 Will Break Previous Records

THE OUTPUT of the Canada Cement Co. so far this year has touched new high record levels. With only a few weeks till the end of the year, and with only a comparatively small amount of business yet to come to the company, the total 1928 business will exceed all previous records—although the total will not necessarily be far ahead of the 1927 figures.

It may fairly be assumed that net profits also will show an increase. Two elements conflict here: in Quebec province the company has received a higher price, resulting from the advance of 25 cents a barrel last spring. In Manitoba and the other prairie provinces, however, there was a cut in prices. It seems reasonable to conclude, however, that on the whole there has been a gain in earnings rather than a reduction when the increases and decreases are balanced up.

The Winnipeg mill of the company has been operating very successfully this year following upon a changeover last year from the dry to the wet process. The prospects for increased business all over western Canada have led the company to decide on an extension to the Winnipeg mill. When the changes were made last year space was provided for an extra kiln. This will be added in time for operation next spring, if required, increasing the number from two to three and adding close to 50% to the capacity of the plant.

Quarry Accidents in 1927

THE accompanying statistical tables, containing information concerning accidents in the stone-quarrying industry in 1927, are published at this time by the United States Bureau of Mines, Department of Commerce, in order to make the figures available to the industry as early as possible. A more extended report, in printed form, will be issued later, copies of which may be had upon application to the United States Bureau of Mines, Washington, D. C.

These statistics were prepared by W. W. Adams and L. Chenoweth, Accident Statistics Section, Mineral Statistics Division, United States Bureau of Mines. F. J. Katz, Chief of Division.

TABLE 1—ALL QUARRIES: MEN EMPLOYED, DAYS OF LABOR PERFORMED, AND NUMBER KILLED AND INJURED IN QUARRIES IN THE UNITED STATES, BY STATES, DURING THE YEAR ENDED DECEMBER 31, 1927

State	Active operators	Men employed	Equivalent in 300-day workers	Man-days of labor	Average days active	Number killed	Number injured	Rates per M 300-day workers Killed	Rates per M 300-day workers Injured
Alabama	23	2,004	1,918	575,330	287	3	194	1.56	101.15
California	119	5,570	5,287	1,586,081	285	13	933	2.46	176.47
Colorado	18	1,316	1,111	333,461	253	....	147	.....	132.31
Georgia	22	2,974	2,788	836,269	281	2	468	0.72	167.86
Illinois	47	4,105	3,644	1,093,179	266	5	483	1.37	132.55
Indiana	42	5,491	5,064	1,519,272	277	10	812	1.97	160.35
Iowa	21	1,489	1,178	353,538	237	....	265	.....	224.96
Kansas	18	1,301	1,143	342,815	264	....	93	.....	81.36
Kentucky	31	1,084	833	249,945	231	1	271	1.20	325.33
Maine	28	1,589	1,433	429,762	270	5	289	3.49	201.67
Maryland	25	1,509	1,294	388,121	257	1	111	0.77	85.78
Massachusetts	59	2,513	2,306	691,747	275	3	806	1.30	349.52
Michigan	19	2,352	2,150	644,909	274	3	271	1.40	126.05
Minnesota	34	1,403	1,217	365,232	260	2	370	1.64	304.03
Missouri	54	3,984	3,283	984,946	247	3	563	0.91	171.49
New Jersey	37	1,943	1,747	524,025	270	3	204	1.72	116.77
New York	90	5,297	4,641	1,392,255	263	7	872	1.51	187.89
North Carolina	11	1,546	1,263	378,984	245	4	121	3.17	95.80
Ohio	88	6,813	6,142	1,842,592	270	10	1,234	1.63	200.91
Oklahoma	12	1,130	1,130	338,926	300	3	169	2.65	149.56
Pennsylvania	262	15,926	14,609	4,382,716	275	24	2,065	1.64	141.35
Tennessee	27	2,624	2,446	733,718	280	6	315	2.45	128.78
Texas	24	1,742	1,809	542,623	311	3	287	1.66	158.65
Vermont	49	4,575	4,513	1,353,846	296	6	581	1.33	128.74
Virginia	46	2,390	2,131	639,339	268	4	269	1.88	126.23
West Virginia	18	1,786	1,637	490,963	275	4	146	2.44	89.19
Wisconsin	62	2,130	1,885	565,564	266	3	452	1.59	239.79
Not segregated	148	4,931	4,007	1,202,403	244	7	668	1.75	166.71
Total	1,434	91,517	82,609	24,782,561	271	135	13,459	1.63	162.92
Total previous year	1,519	91,146	82,361	24,708,400	271	154	13,201	1.87	160.28

Company to Exploit Texas Potash Resources Is Formed

PLANNING "emancipation" from foreign potash control, the American Potash Co. of Texas, has announced a $2,500,000 development of its holdings in west Texas, according to the *Texas Commercial News*.

Potash deposits in west Texas will last, on the basis of present consumption, for 250 years, the article says. About 57,000,000 tons of potash are located in the west Texas territory.

Mining operations, to be started immediately by the company, will result in the production and refining of 2,000 tons of potash daily, company officers said.

TABLE 2—ALL QUARRIES: MEN EMPLOYED, DAYS OF LABOR PERFORMED, AND NUMBER KILLED AND INJURED IN QUARRIES IN THE UNITED STATES, BY KIND OF QUARRY, DURING THE YEAR ENDED DECEMBER 31, 1927

Kind of Quarry	Active operators	Men employed	Equivalent in 300-day workers	Man-days of labor	Average days active	Number killed	Number injured	Rates per M 300-day workers Killed	Rates per M 300-day workers Injured
Cement rock	98	23,220	24,237	7,271,158	213	13	1,676	0.54	69.15
Granite	253	11,034	9,073	2,721,721	247	23	1,977	2.53	217.90
Limestone	715	39,269	33,765	10,129,463	258	73	7,069	2.16	209.36
Marble	33	6,153	5,912	1,773,424	288	5	738	0.85	124.83
Sandstone and bluestone	155	4,150	3,321	996,429	240	5	631	1.51	190.00
Slate	67	3,736	3,196	958,760	257	7	589	2.19	184.29
Trap rock	113	3,955	3,105	931,606	236	9	779	2.90	250.89
Total	1,434	91,517	82,609	24,782,561	271	135	13,459	1.63	162.92

TABLE 3—ALL QUARRIES: MEN EMPLOYED, DAYS OF LABOR PERFORMED, AND NUMBER KILLED AND INJURED IN QUARRIES IN THE UNITED STATES DURING THE YEAR ENDED DECEMBER 31, 1927

Kind of Quarry	Men employed	Equivalent in 300-day workers	Man-days of labor	Average days active	Number killed	Number injured	Rates per M 300-day workers Killed	Rates per M 300-day workers Injured
All quarries:								
In quarry	49,549	41,421	12,426,312	251	99	8,015	2.39	193.50
Outside	41,968	41,188	12,356,249	294	36	5,444	0.87	132.17
Total	91,517	82,609	24,782,561	271	135	13,459	1.63	162.92
Dimension stone:								
In quarry	12,050	10,365	3,109,576	258	23	2,068	2.22	199.52
Outside	9,863	9,317	2,795,006	283	8	1,676	0.86	179.89
Total	21,913	19,682	5,904,582	269	31	3,744	1.58	190.22
Nondimension stone:								
In quarry	31,219	26,232	7,869,404	252	67	4,959	2.55	189.04
Outside	29,186	29,449	8,834,776	303	22	3,110	0.75	105.61
Total	60,405	55,681	16,704,180	277	89	8,069	1.60	144.91

TABLE 4—ALL QUARRIES: FATALITY AND INJURY* RATES PER THOUSAND 300-DAY WORKERS IN THE UNITED STATES DURING THE YEARS ENDED DECEMBER 31, 1924 TO 1927

	Killed				Injured			
	1924	1925	1926	1927	1924	1925	1926	1927
All quarries:								
In quarry	1.90	2.28	2.58	2.39	178.00	195.02	187.46	193.50
Outside quarry	1.24	1.22	1.11	0.87	170.61	141.06	131.01	132.17
Total	1.63	1.78	1.87	1.63	175.03	169.67	160.28	162.92
Dimension stone:								
In quarry	1.28	1.94	2.50	2.22	160.71	180.60	170.73	199.52
Outside quarry	0.81	0.57	0.61	0.86	211.05	197.61	168.80	179.89
Total	1.14	1.40	1.70	1.58	175.89	187.35	169.91	190.22
Nondimension stone:								
In quarry	2.25	2.59	2.64	2.55	189.04	193.41	191.97	189.04
Outside quarry	1.41	1.34	1.28	0.75	156.02	120.99	116.75	105.61
Total	1.88	1.95	1.94	1.60	174.48	156.64	153.08	144.91

*Rates are based upon all lost-time accidents.

Fire Destroys Illinois Rock Products Plants

DAMAGE estimated at $300,000 was done when fire, on December 3, destroyed the factory of the F. E. Schundler Magnesite Co., Joliet, Ill. The fire burned for six hours before fire companies, pumping water from the Chicago drainage canal, could subdue it.

The building was three stories high and occupied several acres of ground. The blaze was discovered by a watchman and was thought to have originated near a furnace. The plant of the Illinois Mineral Grinding Co. was also damaged.

Central Lime and Cement Co. Gravel Operation at Afton, Wis.

IN the editorial letter on the sand and gravel plants along the Illinois-Wisconsin state line, which appeared in the November 24 issue of ROCK PRODUCTS, there was a short description of the plant at Afton, Wis., which formerly was operated by the Howard Material Co. of Chicago. At about the time this plant was visited, the Howard company turned it over to the Central Lime and Cement Co. of Chicago. Through an error the name in the November 24 issue was given as the Western Lime and Cement Co. The latter is a Milwaukee company and does not have any operation at Afton.

A letter from the Central Lime and Cement Co. states that since the plant was visited a dredging operation has been installed there.

New York State Crushed Stone Association Meets at Utica

Discussion of Proposed Lien Law Amendment Continues to Hold the Center of Interest

At ten in the morning of November 23, it looked rather dubious for a real meeting of the New York State Crushed Stone Association, scheduled for that hour, as only four members had gathered at the Yahnundasis Golf Club at Utica, under the cold, raw, snowy weather that prevailed. However, by 11:30 when the meeting was called to order, 16 were in attendance, and a successful meeting resulted.

At the request of President George E. Schaefer, J. E. Cushing, vice-president, presided, and after the usual preliminaries, the group launched directly into the discussion of the "lien law amendment" question, which had been rather fully discussed at the New York City meeting in October. The New York Trap Rock Co., through Mr. Wandell and its attorney, had written to F. C. Owens, secretary of the state association, outlining its opposition to a number of the proposed changes, and particularly to the pro rata basis and the treble damage clause. These communications were presented to the meeting, as were also the decisions of the Solvay Process Co. and of John Odenbach, neither of whom were present. The consensus of opinion, both in the written communications and among those present, was in opposition to the pro rata idea, and also to that of the liability of lienors for false statements in the lien. It was felt that a false lien made willfully should be penalized, but that a mistake in the amount made innocently and unintentionally should not mitigate against the chance of the honest lienor receiving his money. As no differentiation was made between the two, it was resolved to bring the matter to the attention of the New York State Chapter of the Associated General Contractors, who are sponsoring the amendments, to see if a new and more acceptable framework of this amendment could not be devised.

The remaining changes as proposed, were analyzed, but not severely criticized except that of the relationship between liens and assignments, and it was finally decided to take no definite action, pending further consideration of the producers proposed changes by the contractors' association.

The secretary of the New York State Chapter of the Associated General Contractors, Harry Hayes, of Albany, was at the meeting and discussed the whole subject informally at the morning session. He stated that his organization was desirous of cooperating with the crushed stone association and would probably not submit to the legislature, for enactment into laws, any of the proposed amendments on which the producers were unalterably opposed.

Pre-qualification of Bidders

The meeting adjourned for lunch at one, and resumed the discussion in the afternoon session. Mr. Hayes addressed the meeting on "Pre-Qualification of Bidders on Public Work." He said, in part:

"The economic conditions of the industry could be more or less regulated if the industry could be accommodated to some practical plan of organization. This will be impossible until the factors which are tending to disrupt it can be controlled. With the field so overcrowded with construction organizations, and the large addition to the number each year, it would seem to be in the interest of the public to insist that the concerns proposing to undertake our vast public improvement program should be subjected to regulations designed to promote efficiency in the execution of that program and protection to the business upon which rests the responsibility of its completion.

"Awarding public officials are presumed to have some discretionary powers. These have been very frequently disregarded in the past. It is almost impossible to exercise this authority after proposals have been submitted and opened, and when attempted is met with the criticism of favoritism and with the determined opposition of all anticipating some profitable connection with the award of the low bidder. Political and other influences appear which prevent a fair and equitable examination of the proposal and of the qualifications of the bidder. Time, trouble and expense can be saved and a competent decision reached only when the qualifications are reviewed prior to the reception of bids.

"Pre-qualification is merely an examination of an applicant's skill, integrity, and responsibility to determine if he has the necessary equipment, experience and finances to assume the obligations of contracting and to place the limit within which he can successfully operate. It gives the officials an idea of what constitutes responsibility for contracts of different kinds and sizes. It affords a common basis on which contractors can be properly classified. It emphasizes the importance of considering necessary factors which are disregarded or overlooked in attempting to determine the qualifications after proposals are submitted. It would be responsible for a better understanding of their mutual problems and inspire confidence between the engineer and the contractor.

"The qualification of a contractor cannot be properly determined if irrelevant matters and influences are permitted to obscure the pertinent facts to be considered. Pre-qualification lessens the opportunity and weakens the force of such interference. Pre-qualification would educate the official, the contractor and the public to the necessity of using caution in the award of public contracts and provide a measure of protection to all having contact with or interest in a contract for a public improvement.

"It would focus attention on the fact that the construction business should be a highly skilled occupation requiring certain qualifications which are essential to the satisfactory progress of public work. It is recognized by law and adopted by practice that the engineer must be qualified to insure the sufficiency of the design and the competency of the supervision of public work. Why not extend its application to include the contractor who is charged with a responsibility equally as important as the engineer?

Is There Too Much Responsibility for the Public Official?

"It might be said that pre-qualification places too much power with the public officials and this would lead to abuses in the event that some were found to be unscrupulous. The unscrupulous public official will attempt to act contrary to the public interest no matter what authority he possesses and he would be more easily detected under a system which tended to raise the standards of the contracting business. He would find it difficult to dispense favoritism to a class recruited for its skill, integrity and responsibility. As a matter of record, however, such a charge has not been presented in a single instance to my knowledge, in any state which has adopted the scheme of pre-qualification.

"In the last analysis, under any scheme of governmental control, we must trust someone, and under any plan, the unscrupulous official will attempt schemes for his benefit and the arbitrary abuse of the power invested with him. This argument cannot successfully compete with the preponderant factors in favor of pre-qualification.

"The general cause for the failure or unsatisfactory completion of a public improvement is due to the incompetency of the contractor, or to the fact that through unfair competition and the influences of loose credit he has become over-extended.

"Under a brief consideration of the subject of pre-qualification, one who is unacquainted with conditions in the industry, might form the opinion that it would tend to favor the large contractor. He is not granted nor does he receive any consideration which is not accorded to all. His status is determined in the same manner as the smaller contractor.

"All classifications are determined by the ability to establish the essential facts necessary to the proper rating. All contractors

are thereby favored because they are promised fair competition and from only those who are able to discharge satisfactorily their obligations. Pre-qualification would protect all classes of contractors in that it would tend to eliminate factors which are responsible for unfair competition, and for raising up inexperienced, irresponsible, and inadequately financed concerns to demoralize the construction business.

"This chapter has during the past several months discussed this subject very thoroughly with many organizations and public officials who have been very much impressed with its advantages. Notably among these are the New York State Association of City and Village Engineers, the New York State Society of Professional Engineers, the New York State Bankers Association, officials of the State Department of Public Works, the New York State Conference of Mayors and other city officials, editors of engineering magazines, members of organizations of material, equipment and bonding interests, and members of other contractors' associations. There can be no complaint from the new or the old contractor for it will emphasize to both of them that they must be qualified as to experience, capital and equipment before they can be classed as an acceptable bidder. It will caution the bankers of New York state of the necessity for adequate information on contractors as a financial risk. It will make the bonding companies realize the necessity of requiring something substantial to warrant writing the contractors business. It will emphasize to the equipment interests that a fair outlay of cash is essential in the purchasing of equipment and to material men that standard credit terms are desirable to promote a successful conduct of public work. It will eliminate cut-throat and ruinous competition and thereby tend to stabilize conditions in the industry and elevate it to the position it should occupy in the modern business field.

"The law as proposed provides that every official of the state government who is charged with the duty of awarding contracts shall before furnishing plans or specifications require that the proposed bidders shall submit a full and complete statement duly verified, of his financial ability, equipment and experience in order that his qualifications to undertake and fully perform the work contemplated may be determined. It provides that no contract shall be awarded to any person who is not in the opinion of the officer, thoroughly qualified or has not filed such statement. It also gives such power to the officials of the cities of the state with the approval of the local legislative department.

"It is our belief that the proposed law is progressive in its nature; that it will accomplish much needed reforms in the prosecution of public work and that designed as it is for the protection of all allied with this great industry, it should merit and receive their approval and support, and the general public as well who will be the ultimate beneficiary of any improvement in the administration of public works."

After Mr. Hayes talk, a resolution was passed by the meeting favoring pre-qualification. Another resolution was then passed requiring the president to appoint a committee to make the necessary arrangements for a special car to the convention of the National Crushed Stone Association to be held in Cleveland in January. Mr. Seitz, of the Rock Cut Stone Co., Syracuse, was designated to take charge of this matter.

It was resolved to hold the December meeting, which is to be the annual meeting, at Syracuse, on December 19th. President Schaefer authorized to appoint the nominating committee to name the officers for 1929, but this was not done at the meeting. After some further discussion on various topics, the meeting adjourned early to give some of the members a chance to visit one or two of the neighboring operations.

Registration

The following crushed stone companies were represented:

General Crushed Stone Co., Easton, Penn.: George E. Schaefer, president of the New York State Crushed Stone Association, G. J. Murphy.

Buffalo Crushed Stone Co., Buffalo: A.J. Hooker and James Savage.

Dolomite Products Co., Rochester: A. F. Sickles.

Rock Cut Stone Co., Syracuse: W. L. Sporborg, F. C. Owens and A. G. Seitz.

Wickwire Spencer Steel Co., Inc., Gasport: W. E. Foote.

Peerless Quarries, Inc., Utica: A. S. Owens.

L. & M. Stone Co., Prospect: Wm. McGrew.

Cushing Stone Co., Schenectady; J. E. Cushing.

F. W. Schmidt and John Schmidt, Morristown, N. J.

The following guests were present: Harry Hayes, engineering secretary, New York state chapter of the A. G. C., Wm. Anderson, Hercules Power Co.

North Carolina to Have New Marble and Lime Operation

EXTENSIVE DEVELOPMENTS in marble deposits of the extreme southwestern part of North Carolina around Andrews is being planned with preparations now being carried out.

J. A. Martin, of Andrews, has purchased and secured options on some of the best marble deposits in this section, and has already spent around $100,000 in preparing for marketing the marble and other products. Mr. Martin is an experienced engineer, coming to North Carolina from Ohio. He has developed several large stone properties for a number of large companies in this and other countries.

His original purpose was to produce a marble suitable for a terrazzo flooring material, but after prospecting the property thoroughly by core-drilling, he saw possibilities for a larger development by producing building and monumental stone as well.

In addition, several kilns will be built for turning out lime for building purposes and for land plaster. The chief material to be produced at first will be chips of terrazzo flooring. The developer states that he has already made contracts for his entire output of this material.

After looking over the territory, State Geologist H. J. Bryson says, "The extensive core-drilling has revealed several types of marble, namely: coarse-grained blue, mottled, 'Confederate gray,' coarse-grained white, and fine-grained white. At places the drills penetrated the blue marble 28 ft. without encountering a flaw. Some of the older reports state that the marble is highly jointed and broken but this is not the case with depth. The white marble was drilled 17 ft. before a break or crack was found.

"A great number of tests, as compression, tensile, absorption, polishing, etc., were made by the U. S. Bureau of Standards and the Massachusetts Institute of Technology which showed the marble to be equal if not superior to much of the marble now produced in the United States. Comparative tests were made on the white and Italian or 'Carrara' marbles. The standard tests showed that the white was superior to the 'Carrara' in compression and tensile strength and absorption."

Kilns are already under construction and later equipment such as drills, saws, and polishing machines will be installed for the production of building and monumental stone. It is estimated that the completed plant will run the investment into several hundred thousand dollars. Some of the large industrialists of the country are reported to be backing the proposition.

To show the variety of building materials available in the vicinity, Geologist Bryson reported that the high cost of building sand for the plant was overcome by obtaining a good, angular high silica sand from quartzite found on the property. The quartzite was mined and ground to the desired mesh much cheaper than sand could be delivered, he declared.

Later, when the fire brick was needed to line the kilns, it was found that the price was high, and tests were made on the high alumina-silica clay nearby. The tests showed large amounts of high grade fire clay which would stand 3,200 deg. of temperature.

"Instead or ordering fire brick," the geologist declared, "it was decided to use the clay on the property. These fire brick were then backed up with a high alumina schist or slate which is also found on the property. This schist or slate probably gave origin to the high grade fire clay.

"Other than producing the materials mentioned above, experiments will be carried on along other lines. If these tests prove worthy of commercial development, the possibilities in this field are great. It will mean the establishment of a large industry in that section."

Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

	Limestone Flux Week ended		Sand, Stone and Gravel Week ended	
District	Nov. 3	Nov. 10	Nov. 3	Nov. 10
Eastern	2,872	2,764	13,794	12,885
Allegheny	3,723	3,574	9,123	7,537
Pocahontas	428	365	901	848
Southern	702	496	11,862	10,498
Northwestern	1,292	961	6,679	6,128
Central Western	381	467	9,231	9,141
Southwestern	370	342	7,527	6,395
Total	9,768	8,969	59,117	53,432

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1927 AND 1928

	Limestone Flux Period to Date		Sand, Gravel and Stone Period to Date	
	1927	1928	1927	1928
District	Nov. 12	Nov. 10	Nov. 12	Nov. 10
Eastern	150,608	134,728	508,980	515,866
Allegheny	160,690	155,776	386,309	343,142
Pocahontas	23,129	20,986	44,212	37,145
Southern	26,458	26,408	550,355	479,864
Northwestern	60,169	59,861	330,462	303,228
Central Western	22,515	19,982	436,429	463,225
Southwestern	15,910	18,490	263,203	285,660
Total	459,479	436,231	2,519,950	2,428,130

COMPARATIVE TOTAL LOADINGS, 1927 AND 1928

	1927	1928
Limestone flux	*459,479*	*436,231*
Sand, stone, gravel	*2,519,950*	*2,428,130*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning December 1:

SOUTHERN FREIGHT ASSOCIATION DOCKET

42995. **Sand and gravel** from Ellerslie and Warmore, Va., to Carson, Va. Present rate, 79c per net ton. Proposed rate on—Sand and gravel, carload (see Note 3), from and to points mentioned, 55c per net ton.

43016. **Concrete or shale products,** from Southern points to Monroeville, Ala. Combination rates now apply, and it is proposed to establish rates on concrete and shale products, carload, as described in Item 5 of Agent Glenn's I. C. C. A-634, from Southern producing points to Monroeville, Ala., made on the basis customarily employed to short or weak line stations.

43028. **Sand stone, crushed waste,** from Rockport, Ky., to Louisville, Ky. (for beyond). Present rate, $1.20 per net ton. Proposed rate on **sand stone, waste, crushed** carload, minimum weight 80,000 lb.—from Rockport, Ky., to Louisville, Ky. (for beyond), $1.00 per net ton.

43037. **Soapstone, refuse, crushed or ground,** from Clifton and Rockfish, Va., to Cumberland, Mo., and Pittsburgh, Pa. Present rate, 38½c per 100 lb. Proposed rate on soapstone, refuse, crushed or ground, carload (see Note 2), from Clifton and Rockfish, Va., to Cumberland, Md., and Pittsburgh, Pa., $3.66 per net ton—same as the rate in effect from Esmont, Va., to Pittsburgh, Pa.

43051. **Crushed stone** from Boxley, Va., to R., F. & P. R. R. stations. Richmond, Va., combination rates now apply, and it is proposed to establish commodity rates on—Crushed stone, carload (see Note 3), from Boxley, Va., to stations on the Richmond, Fredericksburg & Potomac Ry., on basis of the scale prescribed by the Interstate Commerce Commission under Docket 17517.

TRUNK LINE ASSOCIATION DOCKET

19866. (A) **Sand,** other than blast, engine, foundry, moulding, glass, silica, quartz or silex, carload; (B) **Sand, blast, engine, foundry, moulding, glass, silica, quartz or silex,** carload (see Note 2), from South Amboy and Old Bridge, N. J., to Bristol, Pa., (A) $1.40, (B) $1.50 per net ton. Reason—Proposed rates are fairly comparable with rates on like commodities from and to points in the same general territory.

19874. **Crushed stone,** carload (see Note 2), from Goodman, Pa., to Cleveland, O., $2.50 per net ton. Reason—The proposed rate is the same as in effect from Calcite, Pa.

Note 1—Minimum weight marked capacity of car.
Note 2—Minimum weight 90% of marked capacity of car.
Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

19887. **Stone, natural** (other than bituminous asphalt rock), **crushed,** N. O. I. B. N., in O. C., carload, from Mill Hall, Pa., to Sinnemahoning and Renovo, Pa., $1.25 per net ton. Reason—Proposed rate compares favorably with rates on common sand from Ridgeway to Corry, Pa., and slag from DuBois, Pa., to Driftwood, Pa.

19892. **Crushed stone,** carload (see Note 2), from Water Street, Goodman, Blair, Limestone, Carlim, Canoe Creek, Frankstown, Calcite and Wertz, Pa., to Ebensburg, Pa., $1 per net ton. Reason—The proposed rate is fairly comparable with rates on like commodities for like distances, services and conditions.

19893. **Fluxing limestone,** carload (see Note 2), from Furnace Run, Pa., to Pittsburgh, Pa., 90c per gross ton; rate will only apply when commodity is shipped in open top equipment. During period of car shortage when open top equipment is not available and closed equipment is furnished at carrier's option, the rates provided for open top equipment will apply. Reason—The proposed rate is fairly comparable with rates on like commodities for like distances, services and conditions.

M1049. **Sand** (other than blast, engine, foundry, glass, moulding and silica), and **gravel** carload (see Note 2), from Baltimore, Md., to Hyattsville, Md., 80c per net ton. The proposed rate is based on the Lycoming scale prescribed by the Public Service Commission of Pennsylvania in Docket 7530.

19799. Sup. 1—(a) **Building sand,** carload; (b) **sand, blast, engine, foundry, moulding, glass, silica, quartz or silex,** carload (see Note 2), from Hancock-Round Top District to York, Pa., (a) $1.40; (b) $1.53 per net ton.

WESTERN TRUNK LINE DOCKET

961B. **Sand,** carload (see Note 2), but not less than 40,000 lb. From Hawarden, Ia. To stations in So. Dakota, of which the following are representative:

To	Present	Proposed S. D. Scale
Alcester	3.5c	3c
Centerville	5	4
Yankton	5	4.5
Salem	7	5.5
Riverside	10	7
Sioux Falls	10	7.5

6729. **Sand,** carload (see Note 2), except that when weight of shipment loaded to full visible capacity of car is less than 90% of the marked capacity, the actual weight will apply, but in no case shall the minimum weight be less than 40,000 lb. From Chippewa Falls, Wis., to Eau Claire, Wis. Present—52c per net ton, distance scale for 11 miles, which applies on local shipments. Proposed—Proportional rate of 30c per net ton to apply only on sand moved from Chippewa Falls to Eau Claire, conditioned and reshipped to interstate destinations.

1564P (redocketed). **Stone, crushed,** carload (see Note 2), but not less than 40,000 lbs., from Dell Rapids, S. D., to Osage, Ia. Present—$2.22. Proposed—$1.94. (By shipper.)

6720. **Stone or granite, rough quarried** (not sawed or suitable for monumental or building purposes) (see Note 2), from Lohrville, Wis.

	To Detroit, Mich.	To Cleveland, O.
Present	$6.30 per net ton	$7.20 per net ton
Proposed	2.20 per net ton	2.70 per net ton

ILLINOIS FREIGHT ASSOCIATION DOCKET

4082A. **Crushed stone,** carload, from Linwood and Buffalo, Ia., to Beloit, Janesville, Milwaukee and Racine, Wis. Rates per net ton—Present, $1.60; proposed, $1.30.

4786. **Crushed stone,** carload (see Note 1), from Shetlerville, Ill., to Camdon, Ill., via I. C. R. R. and C. B. & Q. R. R. Present—None in effect. Proposed—$1.52 per ton of 2000 lbs.

4788. **Sand,** carloads, from Ottawa district to Owen Sound, Ont. Present—$5.04. Proposed—$5.40.

CENTRAL FREIGHT ASSOCIATION DOCKET

20059. To establish on **sand and gravel,** in bulk, in open cars, carloads, Miamiville, O., to Kennedy Heights, O., rate of 65c per net ton. Present rate—70c per net ton.

20060. To establish on **gravel and sand,** carloads, Randles, O., to Roseville, O., rate of 80c per ton of 2000 lb. Present rate—13c.

20083. To establish on **crushed stone,** in bulk, in open cars, carloads, Marble Cliff, O., to Lake View, O., via N. Y. C. R. R. Rate of 100c per net ton. Present rate—150c per net ton.

20084. To establish on **gravel and sand,** in open top cars, carloads, Zanesville, O., to Dresden and Trinway, O. Rate of 60c per ton of 2000 lb. Present rate—70c per ton of 2000 lb.

20085. To establish on **quarry scrap,** carloads, Constitution, O., to East St. Louis, Ill. Rate of 390c per net ton. Present rate—29c.

20089. To amend the various items in C. F. A. L. Tariff 218E and similar items in individual lines' tariffs publishing rates on **limestone, ground or pulverized,** carloads, **limestone dust,** carloads, **sand, blast, building, filling, glass or molding and gravel,** carloads, **stone, crushed, rip rap, chip or waste,** carloads, from points in C. F. A. territory to points east of the western termini of Eastern Trunk Lines by providing for the following minimum weight:

"Minimum weight 90% of marked capacity of car, but not less than 72,000 lb., except:

(a) When car is loaded to full cubical or visible capacity, actual weight will apply, but not less than 72,000 lb.

(b) The minimum weight on limestone, ground or pulverized, in box cars, also limestone dust, in box cars, 50,000 lb."

20097. To establish on **crushed stone** (in bulk) and **limestone, unburned, agricultural** (in bulk in open top cars only), carload, from Kankakee, Lehigh, Van's Siding and West Kankakee, Ill., to points shown below, following rates (in cents per net ton):

Destination	Proposed Rate	Present Rate Chicago	Present Rate Kankakee
To points on C. K. & S. Ry.			
Richland Jct., Mich.	140	161	161
Hastings, Mich.	140	161	161
Woodbury, Mich.	140	161	161
To points on M. C. Railway			
Findlay, Mich.	125	140	140
Fairfax, Mich.	125	140	140
Hastings, Mich.	140	161	161
Bowen, Mich.	140	161	161
Eaton Rapids, Mich.	140	Class	Class

20105. (a) To cancel local commodity rates as published in Items 515 to 629 of C. F. A. T. B. Tariff 400J, on **granite, crushed,** or **quartz, broken or crushed,** carload, from St. Louis, Mo., East St. Louis, Ill., and points taking same rates to C. F. A. territory. (b) To restrict the rates as published in Items 515 to 629 of C. F. A. T. B. Tariff 400J, to apply as proportional rates from East St. Louis, Ill., on traffic originating at points west of the Mississippi River.

20113. (Cancels White Dkt. Advice 20042). To establish on **crushed stone,** in bulk, in open cars, carload, from Middleport, O., to Akron and Barberton, O., via Penna, R. R., rate of 100c per net ton. Present rate—90c per net ton.

20118. To establish on **sand and gravel**, carload, Lorain, O., to Fairport Harbor, O., via N. Y. C. & St. L. R. R., Painesville, O., and B. & O. R. R. rate of 90c per net ton. Present rate—Sixth class.

20120. To establish on **gravel and sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding and silica), carload, from Kenneth, Ind., to Rensselaer, Ind. (C. I. & L. Ry. delivery), rate of 85c per net ton. Present rate—$1.04 per net ton.

20141. To establish on **crushed stone**, carload, from Spore, O., to points shown below, following rates (in cents per net ton):

	Rate
Adams Mills, O.	105
Black Run, O.	100
Conesville, O.	105
Coshocton, O.	115
Frazeyburg, O.	100
Hanover, O.	100
Trinway, O.	105

Present rates—Sixth class. Route—N. Y. C.-P. R. R.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

15683. **Sand, common** (not moulding, fire, filter or blasting), **run of the bank or screened, gravel, screened**, carload (see Note 3), from North Wilbraham, Mass., to Troy, N. Y., $1.35 N. T. via B. & A. R. R., Rensselaer, N. Y., N. Y. C. R. R. Reason: To establish same rate on sand and gravel from North Wilbraham, Mass., as applies on trap rock from Westfield, Mass.

15736. **Dolomite or fluxing stone**, carload (see Note 2), from Sheffield, Mass., to Bridgeport, Conn., $1.36 net ton. Reason: To permit of movement from Sheffield, Mass., at the same rate as now in effect from Ashley Falls, Mass.

SOUTHWESTERN FREIGHT BUREAU DOCKET

16214. **Rock asphalt**, from Sunnyside, Utah, to Amarillo, Tex. To establish rate of $6.10 per ton of 2000 lb. on rock asphalt, carloads (see Note 1), from Sunnyside, Utah, to Amarillo, Tex. There is a deposit of rock asphalt at Sunnyside, Utah, and the shippers have set up a crushing and grinding mill and have requested publication of equitable rates to Chicago, St. Louis and other eastern destinations and request that consideration be given to providing a rate to Amarillo, Tex., in order for them to compete with other points of production, such as Bowling Green, Ky., and Uvalde, Tex.

16231. **Sand and gravel**, from Texas points to points in Oklahoma. To establish rates on sand, gravel, etc., carloads, description and minimum weight as per Item 4740A of S. W. L. Tariff 26Y, from G. C. & S. F. Ry. Texas points to points in Oklahoma on the G. C. & S. F. Ry. and A. T. & S. F. Ry., the same as now currently applicable in the reverse direction in the item referred to. It is stated that the present scale of rates from G. C. & S. F. Ry., Texas points to Santa Fe Oklahoma destinations are considerably higher than those in effect for account of other lines.

I. C. C. Decisions

19813. Cement Complaint Dismissed. In the case of the Colorado Portland Cement Co. vs. Ahnapee and Western, the commission has found the rates on cement from points of origin in cement Scale II and cement Scale III territory to destinations in cement Scale IV territory other than Colorado, not unduly prejudicial or preferential. The complaint covered destinations in Scale IV territory in South Dakota, Kansas, Nebraska and Wyoming. The complainant, with plants at Portland and Boettcher, Colo., alleged undue prejudice against itself and undue preference of competing mills and of intrastate commerce from certain of them in violation of sections 3 and 13. Commissioner Porter said the allegation of section 13 was predicated upon the fact that cement mills in Scale III territory in Kansas and Nebraska enjoyed relatively lower rates than did complainant to destinations in those respective states in Scale IV territory.

17952. Gypsum Block Rate. The commission on reconsideration has reversed the findings of the former report on gypsum blocks, carloads, from Port Clinton, Ohio, to Detroit, Mich., and has found the rate in effect between June, 1923, and October, 1924, was unreasonable, and has awarded reparation. The finding on reconsideration is that the assailed rate was unreasonable to the extent it exceeded $1.65 per net ton, minimum 60,000 lb., marked capacity of car to govern when less.

18089. Ganister Stone Rates. The commission has found the rate on ganister stone from Flowing Spring, Horrell, Goodman, Moore's Mills, Port Matilda, Brooker Mills and Baree, Penn., to Niles, Ohio, unreasonable but not otherwise unlawful. A rate of $1.90 per net ton, effective not later than July 20, 1928, has been ordered.

19338. Demurrage on Cement. In the case of John Wroe vs. Louisville and Nashville, the commission dismissed the complaint on a finding that demurrage charges collected for the detention of 32 cars of cement at Walton, Ky., were applicable. Complainant contended that he had received no written notice of arrival of cars which were placed on a track near his plant, but commission held that the oral notice he received was sufficient.

19832. Crushed Stone Rates. Rates on crushed stone from De Kalb Junction, N. Y., were unreasonable to the extent they exceeded $3.83 per 2000 lb. to Cleveland, Ohio, $4.21 to Gypsum and Toledo, Ohio, and Detroit, Mich., and $5.40 to Chicago, Ill. Charges were collected at the applicable joint rate of $5.80 to Chicago, and $4.60 to the other destinations named, minimum weight, marked capacity of car. Effective July 1, 1926, the rates, minimum 60,000 lb., to the basis of which reparation is to be made, were established.

19946. Bulk Lime Rate. The commission has found that the applicable class C rate of 29.5 cents on bulk lime, carloads, from Duluth, Minn., to Merrill and Lancaster, Wis., was unreasonable and unduly prejudicial to the extent that it exceeded the subsequently established rate of 20.5 cents and that complainant is entitled to reparation.

17606. Sand Rates Prescribed. Former rates on sand and gravel from Cleves, Ohio, to Independence and Butler, Ky., unreasonable and new rates ordered established.

I. C. C. Recommendations

19625. Sand. It is recommended that the commission dismiss the complaint on a finding that there was no damage resulting from a rate on sand from Lawrence, Kan., to Kansas City, Mo., which was unduly prejudicial prior to February 28, 1927. The recommendation states that the undue prejudice has been removed, and hence the present rate should not be unreasonable, and there is no need for action in the future.

20039. Agricultural Limestone. It is recommended that the rates on agricultural limestone from Gibsonburg, Ohio, to points in Michigan be found unreasonable but not otherwise unlawful, and reparation be awarded. The proposed finding is that the rates were, are and for the future will be unreasonable to the extent that they exceeded, exceed or may exceed the rates set forth in an appendix, distances to be computed via the shortest routes over which carload traffic can be moved without transfer of lading. The rates in the appendix run from 115 cents per net ton for 40 miles and under to 200 cents for 325 miles and over 300 miles, graduated in 10-, 15-, 20- and 25-mile blocks, 5 cents being added for each block. The 10-mile blocks end at 100 miles, the 15-mile blocks at 145 miles, the 20-mile blocks at 225 miles and the 25-mile blocks at 325 miles.

20023. Common Sand Rate. It is recommended that the commission find unreasonable the rate on common sand from Menantico, N. J., to Amcelle, Md., to the extent it exceeded or may exceed $5.70 per net ton, and that the commission prescribe that rate and award reparation on that basis. It was also recommended that the commission should find not unreasonable the rate on gravel to and from the same points.

20231. Sand Rate. It is recommended that the commission find that the rate on sand from Algonquin and Carpentersville, Ill., to Buffington, Ind., unreasonable and in violation of the aggregate-of-intermediates rates provision of the fourth section to the extent it exceeded $1.06 per net ton, but was not otherwise unlawful. Reparation should be awarded.

19999. Gravel Switching Rates. It has been recommended that the commission find unreasonable and unduly prejudicial the switching rate of the Burlington, Muscatine and Northwestern on sand and gravel from Muscatine, Iowa, to interstate destinations on or via the Chicago, Rock Island and Pacific, and the Chicago, Milwaukee, St. Paul and Pacific, to the extent it may exceed $3.15 per car.

Lime Rates in the Southwest

EXAMINERS A. E. Later and A. G. Hagerty, in No. 20887, United States Lime Products Corp. vs. Santa Fe et al., have recommended that the commission find not unreasonable but unduly prejudicial the rates on lime and lime products from Sloan, Nev., to destinations in California to the extent that they are subject to a minimum higher than that concurrently maintained from any other lime shipping point in Nevada, Arizona and California, and to the extent that the rates from Sloan to San Diego, Calif., and from Sloan to other points in California, Bakersfield and north in both the San Joaquin valley and on the Southern Pacific coast lines, exceed the rates contemporaneously maintained from Puntenney, Ariz., to those destinations.

Best Brothers Keene's Cement Co. Plant Being Enlarged

WHILE the output of the local Keene's cement mills has doubled within the past few years, the development of new markets for the materials made by the Best Bros. Keene's Cement Co. has taken up the extra production almost as soon as it was available. Further extensions both to the quarries and mills are now being planned, which when completed will result in further increase of nearly 100% over the capacity of the present plant. Work on them will be started as soon as the new raw storage building and track hopper are in operation.

A 150-hp. semi-diesel engine with alternating current generator has been purchased for the quarry and will replace the various small power units now in service. A high voltage transmission line will connect the new power house with the various pits. A complete private telephone system will be installed, with a central switchboard in the new quarry office, and connections with the various pits, cableway terminals and other parts of the operations at Sun City.

The small locomotives now in use will be kept for switching purposes in the pits, and more powerful Plymouth locomotives used for the main line hauls. A new crusher, screens, air hammers and largely increased bin storage are also to be installed.

Two additional rotary kilns and coolers are planned for the mills at Medicine Lodge. The coolers will be of the same size as the present ones, but the kilns will be 15 ft. longer than the ones now in service, and will have a correspondingly greater capacity. The first unit of one kiln and cooler has already been purchased and is scheduled to arrive at the plant the first week in November. A new kiln stack will be erected, 125 ft. high and large enough to serve four kilns.

A two story addition, 72 ft. in width and from 60 to 80 ft. in length will be built on the east end of No. 3 mill, replacing the old No. 3 power house.—*Medicine Lodge* (Kan.) *Index*.

Rock-Dusting Urged as Security Against Mine Gas Explosion

COAL MINE OPERATORS are urged to give particular consideration to mining hazards which accompany cold weather, in a statement issued November 15 by the director, Scott Turner, of the U. S. Bureau of Mines, Department of Commerce. The statement follows in full text.

With the approach of cold weather, and the consequent working of coal mines to full capacity, it is urgent that bituminous mine operators review their safety problems, with special attention to rock-dusting as a means of preventing coal-dust explosions.

At this season, coal-mine passageways tend to become dry, with resultant dangerous accumulations of coal-dust. Rock-dusting is a proven method of preventing coal-dust explosions, and mine operators who have not yet adopted rock-dusting should by all means do so, both as a moral obligation and as a form of business insurance in the protection of life and prevention of destruction of property in their mines.

Suggested Precautions

The principal recommendations call for rock-dusting in all passages or entries and in all rooms and pillar workings, to within 40 ft. of the face, the rock-dust to cover top, floor, sides, and timber. As additional defense, Mine Safety Decision No. 5 of the Bureau of Mines also recommends "that rock-dust barriers be used to sectionalize the mine; these should be regarded as a substitute for generalized rock-dusting."

As concerns the size of particles of rock-dust, all should pass through a 20-mesh sieve, and 50% or more should pass through a 200-mesh sieve; also the rock-dust should not contain more than 25% of free silicia. A white dust like limestone or gypsum is preferable, as such dusts increase illumination and make it easier to discern subsequent depositions of coal-dust.

The most important specification states that the percentage of inert or incombustible material in the mine dust in every part of the mine shall be maintained at least at 55% or more, and in parts of the mine where methane is found in the ventilating current, the amount of incombustible material shall be raised 10% for each 1% of gas.

Weekly Inspection Urged

It has been found that one of the most important aids to effective rock-dusting is the systematic taking of samples of the mine dust at least once a week, analyzing or determining by a volumeter the noncombustible content, and recording same in a record-book to insure that rock-dusting is being properly done. Another excellent practice towards maintaining rock-dusted surfaces in safe condition is the use of sprays on machine cutting chain and the wetting of mine cars in transit.

This prevents coal-dust getting into the air and being distributed, which requires more rock-dust to neutralize. Thus the danger is decreased and the cost of preventing coal-dust explosions lessened.

Big Aggregate Order

SEVEN MILLION TONS of sand, gravel and crushed rock will be used in the construction of the San Grabriel dam which is soon to be erected near Los Angeles, Calif. Usually commercial plants are not invited to bid for furnishing the aggregate of large hydro-electric propositions, but in this case proposals were furnished to aggregate producers and contractors were invited to bid in three ways, with the county furnishing all the aggregates, part of the aggregates and none of the aggregates, the contractor buying them from commercial plants or producing them himself.

The schedule calls for:

	Tons
Sand, nothing over ¼-in.	2,200,000
Rock and gravel, ¼-in. to 1⅛-in.	1,700,000
Rock and gravel, 1⅛ in. to 3-in.	1,300,000
Rock and gravel, 3-in. to 8-in.	1,800,000
Total	7,000,000

Another schedule calls for approximately half of the above total.

According to the *Los Angeles Times*, only one company bid for supplying the aggregate, the Union Rock Co., of Los Angeles. Its bid was $3,670,000 for the total and $1,809,000 for a little more than half. These prices were f.o.b. plants and figure close to 55 c. a ton. Prices recently quoted in the open market in Los Angeles were 90 c. for sand and $1.20 for rock and gravel.

The size of the order may be appreciated when it is compared with the annual consumptions of large and growing cities. It is a little less than the annual consumption of Chicago, which is commonly set at 8,000,000 tons and a little more than the consumption of the Pittsburgh district, estimated as 6,000,000 tons. According to a recent survey, it is a little less than half of what southern California produces annually. The plants of southern California could easily care for such an order, however, as they are said to have an annual capacity for 34,000,000 tons.

Yield of Alfalfa Crop Increased With Gypsum

IT HAS BEEN KNOWN for several years that sulphur increased the yields of alfalfa in certain sections of Oregon, but until recently practically nothing had been reported in this line of experimental work in the Upper Mississippi valley.

The Iowa station recently reported the results of some trials with gypsum, 20% of which is sulphur. Gypsum is calcium sulphate composed of calcium, sulphur and oxygen, plus water. It was used as a fertilizer as many as 150 years ago in European countries. Its experimental use with general farm crops in various parts of this country has not indicated the necessity for its general use. These experiments with alfalfa indicate a possibility of using gypsum to good advantage.

Averaging all trials, 150 lb. of gypsum per acre increases the yield of alfalfa by 833 lb. per acre; 200 lb. gave 964 lb.; 300 lb. gave 1075 lb., and 500 lb. gave 1335 lb. of alfalfa hay per acre increase over the check plots not treated. In no trial did the gypsum fail to show an increase in yield. The highest increase was 3060 lb. and the lowest 500 lb. of alfalfa per acre.

The results with oats and clover were more variable than with alfalfa and were of such character that not nearly as much importance can be attached to them as with the increases from alfalfa.—*Prescott* (Ark.) *Picayune*.

Cement Products

Research and the Cement Products Industry

What the Northwest Concrete Products Association Is Accomplishing with the Aid of the University of Washington

THE concrete products industry is continually becoming more exacting in the standard of the units which are turned out (whether they be block, pipe or any of the many special articles) and in the forefront of this fight for high quality products the various associations of manufacturers are to be found putting forth their best efforts toward this end. The work of the National Concrete Products Association is well known. Hardly less known is the work of some of the local associations such as that in Wisconsin, where building code revisions and other reforms have been carried out, or in Ohio, or in any of the other numerous local groups. Of the district groups, probably the most active is that of the Northwest Concrete Products Association, which for a long time has stood for the best in the products industry. But one of the most important phases of this association's work is more than merely standing for the development of the industry—it is in showing how that development should take place. This work of the Northwest association has taken the form of aiding research work along lines beneficial to the industry, and which the work is comparatively new, already some worthwhile data have been gathered.

Research on Concrete Pipe

More than a year ago this association announced a prize for research work along the line of a study of concrete pipe. The Pacific northwest is a fertile field for concrete pipe at the present time, and as little work had been done satisfactorily on this particular product in previous research, it was chosen as the field for study. Because of the facilities available in Seattle, the prize was announced for men in the engineering college of the University of Washington, which is located in that city. The prize was to be of $200, and one condition was that the student must carry on personally research along this line for at least two quarters of the school year.

The announcement of this research award decided 23 men to work along this line. Of these 23, two men were outstanding at the end of the half year. They were W. T. Wright and R. P. Rodgers, who worked under the direction of I. L. Collier, director of the Materials Research Laboratory at the University of Washington. Although the results obtained were not all that had been hoped for, this was considerably due to the lack of time and extended research, either by these two men or others who follow after them, should permit of outlining the properties of concrete pipe with more definite knowledge than has ever been done before.

RESEARCH work in the cement products industry is a comparatively new development, but one which promises much for the future. This abstract of the work done at the University of Washington during the past year is given here as an indication of what can be done rather than as a detailed account of the experiments conducted. This particular work was carried on to study certain properties of a special product—concrete pipe—but the principles of research and the necessity for it are applicable to any line in the products industry, just as truly as they are to this one particular phase.—The Editors.

The work of the investigation was carried on largely at the plant of the Concrete Pipe Co. in Seattle, where a laboratory was established and the work of casting the pipe and testing it for strength and water-tightness were carried on. This plant was the most accessible from the university, and the management offered the necessary co-operation. The cylinders used in the investigation were broken in the university laboratory.

Relationship Between Strength of Cylinders and Pipe Sought

It was decided to limit the field of research to attempting to discover some relation between the crushing strength of concrete pipe and of concrete cylinders, both made from the same batch of concrete. The usefulness of the relation sought is readily seen. It would make possible the carrying on of research in the laboratory, since most laboratories do not have the means of making pipe, while cylinders can be ready made and tested. Once this relationship was established, any laboratory could go on studying the development of economical mixes for pipe, and these could later be readily applied to the manufacture of pipe in the plant.

It was expected that a different relationship would be found for each size of pipe, and also that the thickness of the wall and the type of mix would effect the relation.

When Mr. Wright and Mr. Rodgers began their research it was thought that it would be necessary to make only five samples of each size of pipe, but they soon discovered that only through taking as many samples as possible could good results be obtained. It is estimated that 40 to 50 samples will be necessary before any relation can be stated with any degree of truth. In other words, there is much yet to be done in this particular line of research alone.

As in all research work, particular care had to be taken. Especially was it necessary to produce a cylinder as nearly identical with its corresponding pipe as it was possible to make it. It was not found feasible to tamp the cylinders in the pipe machine on which the pipe were made, and so they were hand-tamped, the condition of the pipe machine being reproduced as nearly as possible. Thus a probable error, due to the human factor, entered the work at this point, and

some of the results indicated that this one fault might cause a wide variation in the research results. The report recommends that for further study along this line some means be found whereby the tamping be all accomplished by some one means, and it is further recommended that mechanical tamping be used.

Curing the Samples

In curing, the usual conditions prevailed as the cylinders and pipes were placed in the company's regular curing rooms, along with the day's run of pipe. Results from this curing would have been all right if the samples had not frequently been lost or broken because of being placed near the regular batch. If the research man could have been on hand when the kilns were opened much of this trouble could have been done away with and the pipe could then be transferred to the yard for further curing. The two research workers point out the importance of curing in obtaining excellent samples for their work, but it is no less necessary to watch the curing to obtain good results every day in the plant.

Concrete samples were taken for each sample of pipe, and also the water-cement ratio of the mix was determined. In determining the type of mix to use a mechanical analysis curve was used. This was the same curve that F. R. Zaugg, secretary of the Northwest Concrete Products Association, had worked out and presented to the association some time before. It was noted that the average run of aggregates did not follow this curve very well, and that it was necessary to screen them and recombine them to get the desired results. However, the tests showed that with the poorly graded aggregate, well tamped, the strength was not appreciably lower, although the water-tightness was less.

Results of the Work

As before stated, the work of Mr. Rodgers and Mr. Wright cannot conclusively show the relationship sought, but it does show a tendency, and may well be a basis for future work. In the work done the results appear somewhat contradictory in regards to the effect of different samples of mix on different sizes. Thus in the 3-in. and 6-in. size the tendency seems to be that as the strength of the cylinder increases the ratio of the pipe strength to the cylinder strength decreases, but on the other hand, in the 4-in. pipe, the tendency appears to be just the opposite. As would be expected, it was found that in all cases where the cylinder strength was high, the pipe strength was also high, so that the ratio of the strength was used as the factor to be sought. The apparent contradiction in the results may arise from insufficient data, or may actually be the true results for the specific sizes of pipe studied, since it is easily possible to conceive of such factors as arch action under varying lengths and thicknesses entering the problem.

Aside from the specific matters sought directly, there were other interesting facts brought to light in the research. One of the chief of these is that the pipe broken showed extremely high strength, seldom running under 1200 lb., and the students concluded that more strength was being built into the pipe than was necessary to meet any ordinary specifications. The value of this side issue is at once apparent, since investigation and laboratory research will be able to bring out a practical mix which will not be strong to an excess, and which will consequently be economical.

If the thickness of the wall is to be made larger, then the cement should be cut down, and if the thickness of the wall is cut down, then the cement would be increased. There must be certain values which are the most economical from the viewpoint of materials, forms, handling and any other factors. If these values can be found through research the benefit would accrue to every manufacturer of concrete pipe.

Strength Affected by Curing Conditions

Another supplementary notation made in the report of the research at the University of Washington was that the curing was the largest factor in fixing the strength of the product. If this can be proved by further research, why should not the pipe be cured with greater care, and thus perhaps cut down on the amount of cement and aggregate necessary to obtain higher strength? This would mean possibly the hiring of one yard yard man or the procuring of extra sprinkling facilities, but should result in considerable saving in the cost of production.

The other point called to the attention is that there is very evidently a wide range in the mix at any one plant, and this must, as a matter of course, result in a variation in the strength of the products produced, some having a high cement content and hence a high strength, while others having a small cement content and consequently a low strength. Uniformity in mixing and getting the batch into the molds should do much to correct this, and it was pointed out that much corrective work could be done along these lines at the plant itself without any research being necessary.

The work at the University of Washington is only a start toward what can be done, and what undoubtedly will be done in the cement products industry in the near future. The various associations within the industry will find it to the advantage of their members to encourage such work. As a general rule they will find that engineering colleges which have the facilities at hand will welcome the opportunity to give their students some research work in a field which has such great possibilities. More than that, the students themselves will be glad of this opportunity. If a spirit of co-operation is built up between the industry and the universities of this country much valuable data can be gathered, and the work of students, graduates, professors and practical producers can be correlated and made to work for the industry as a whole.

Wisconsin Products Men to Meet in January

PLANS are going forward for the 1929 convention of the Wisconsin Concrete Products Association, which will be held in Milwaukee on January 10 and 11. The convention is a month earlier than usual this year, so that there is not a great deal of time left for the Wisconsin producers to think about making plans to show up at the meeting. The notices have already been sent out to all the members and a record turnout is expected. This annual convention has always been the source of fine material to the producers of the state and in recent years representatives from plants in adjoining states have been on hand to profit by the papers and discussions. The Cast Stone Manufacturers of Wisconsin will meet with the larger association this year and will have a special session on the evening of January 10, while the big banquet of the convention will be held on the second evening. The sessions will all be held at the Plankington hotel.

A.S.T.M. and Concrete Institute Working on Concrete Brick Specifications

THE committee on brick of the American Society for Testing Materials is giving consideration to revisions of its "Tentative Specifications for Concrete Building Brick," and in doing so is co-operating with a committee of the American Concrete Institute. It is hoped to arrive at uniform specifications for concrete brick in the two societies.

White Rock Silica Sand Co. Starts Operations

THE new crushing and washing plant of the White Rock Silica Sand Co., Browntown, Wis., recently started operations producing seven sizes of silica sand. The finer grades of this sand will be sacked for shipment, but the coarser material will be shipped in paper lined cars. The operators expect to dispose of their production to the glass industries and for miscellaneous fillers, paints, cleansers, toothpastes and similar uses.

Dr. Robert W. Wehenn leased the property from which the sand is taken, and W. J. Newman Co., Chicago, handled the financing, and to date over $200,000 has been invested. The plant has a capacity of 10 cars per day, employs 26 men, uses 580 hp and has storage capacity for 16 carloads.

C. L. Grutze Obtains Control of Concrete Pipe Co. of Portland, Ore.

COMPLETE control of the Concrete Pipe Co. of Portland, Ore., one of the oldest in the northwest, passed to C. L. Grutze on November 20. Mr. Grutze has been secretary-treasurer of the firm for several years.

Claire Bullen, formerly president of the company, but now residing in Chicago, and Chris Spies will retire from the firm under the new organization. Through the deal just consummated the holdings of Mr. Grutze in the concern which the three men have owned in Chicago, Ill., and Spokane and Walla Walla, Wash., will pass to Mr. Spies and Mr. Bullen, who will now retire from the Portland field.

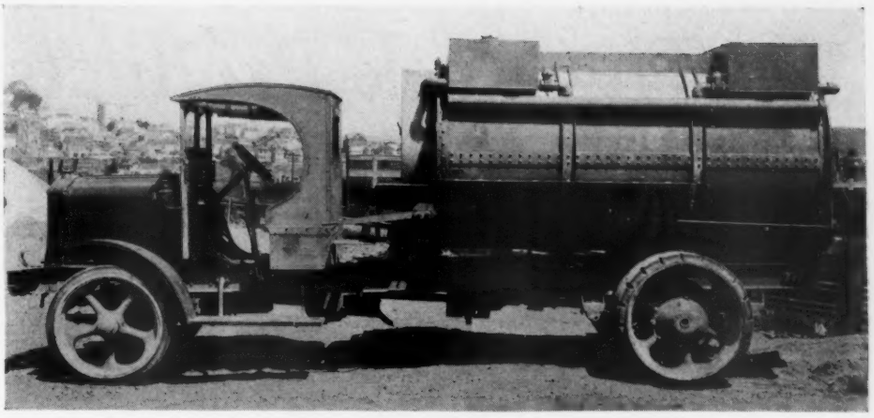
The Concrete Pipe Co. was established in 1909. The company will continue to handle pipes for public and private demand, including the specialty, "Supertile."

A New Non-Elevating Type of Truck Concrete Mixer

A NEW type of truck concrete mixer is being placed in service by a number of ready-mixed concrete dealers in San Francisco and the vicinity. This new unit is manufactured by the American Truck Mixers Corp. of San Francisco. Its particular feature is that the body is non-elevating, the batch being forced out of the mixer body automatically instead of being dumped out.

Looking into the mixer compartment of the new truck which is non-elevating

Mixing is accomplished by a series of large double-locked blades set on a rotating shaft which is driven by the truck motor. These blades do all the mixing, the drum being fastened rigidly to the chassis of the truck. The drum is open along the top, permitting a clear view of the mixing within. It is stated that the mixing action requires very little additional power, and that this unit will start up even with a dry batch with surprising ease. A 3-yd. batch becomes thoroughly mixed in approximately 1½ minutes. It is practically self-cleaning, as very little material remains after a load is dumped.



A new type of concrete mixer body for trucks, which has recently been put into service on the west coast

The absence of hoisting with this model means that less head room will be required when it discharges its load on the job, and this is frequently a big factor on building construction where the ceiling height is limited. Moreover, it means that there will be greater clearance under the bunkers and bins at the central plant. Of course the other feature of this construction is that as the hoist is eliminated, the cost of the unit is materially decreased.

One of the models has transverse water tanks mounted on top and supplying the water by gravity to the drum. Another model is constructed with the water compartment built integrally with the drum, and using pressure to supply the water to the mix. The latter is of lower height and is especially adapted for city construction work, where it will be necessary for the truck to enter buildings.

The truck mixers are built in 1-, 2-, 3- and 3½-yd. capacities and fit and standard truck of corresponding capacity. The body is a three-quarter cylinder of riveted steel built in three sections. It is easily removed by loosening 16 bolts that hold it to the frame, at which time it can be lifted off. Power is obtained from the truck motor through a simple transmission and is controlled by a hand lever. The discharge gate is hinged and is opened or closed by means of a rod extending to the forward part of the body where it is connected to a hand lever within reach of the driver. The discharge gate is also equipped with an extra sliding gate which can be opened and closed by a lever and which permits any quantity of concrete to be discharged. When sufficient has been obtained the gate can be closed and the flow stopped. A water gauge and time clock on every mixer assure correct proportions and accurate timing.

Study of Concrete Stone

IN the field work of the American Concrete Institute Committee on Concrete Stone Specifications it is proposed to study as many cast stone jobs as possible in order to ascertain why each particular job is satisfactory or unsatisfactory as the case may be. When the resulting observations and data are assembled and correlated it is expected that some definite conclusions can be drawn.

The association committees on organization and specifications are laying a foundation for the work of the A.C.I. committee. Both the association committees held a meeting in Boston, September 27 and 28. Members of these committees were:

Organization: W. D. M. Allan, Louis A. Falco, Herman Frauenfelder, William P. Eddy and M. A. Arnold.

Specifications: W. D. M. Allan, Herman Frauenfelder and Louis A. Falco.

It was agreed in these meetings that the standardization of cast stone was the important matter for consideration and that steps should be taken to get before architects and contractors the information which is necessary for an intelligent choice of cast stone for any particular job.

Two broad classifications of cast stone were agreed upon as a basis for understanding and co-operation among the various manufacturers. "Cast stone" and "cut cast stone" are the two general terms which will be used to denote the differences in cast stone due to the manner and extent of finishing. It is the purpose of the association to expand each of these classifications in order to standardize finishes and give architects and builders a clearer understanding of exactly what is involved in the various kinds of finishes.

The committee on specifications recommended to the A.C.I. Committee P-3 that compressive strength be not less than 3500 lb. per square inch at 28 days and that the absorption be not less than 3% and not more than 7% by weight of the dry specimen. These values for strength and absorption are being submitted to the membership of the association.—*News Letter of the American Concrete Institute.*

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	1.75	1.60	1.30	1.30	1.30
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Farmington, Conn.	.....	1.30	1.10	1.00	1.00	.....
Frederick, Mo.	.50– .75	1.35–1.45	1.15–1.25	1.10–1.20	1.05–1.15	1.05–1.10
Ft. Springs, W. Va.	.40	1.35	1.30	1.25	1.20	.....
Munns, N. Y.	.75	1.25	1.25	1.10	1.00	.....
Prospect, N. Y.	.85	1.15	1.15	1.15	1.15	.....
Rochester, N. Y.—Dolomite	1.50	1.50	1.50	1.50	1.50	1.50
St. Vincent de Paul, Que. (n)	.75	1.35	1.15	.95	.85	1.20
Walford, Penn.	.....	.....	1.35h	1.35h	1.35h	1.35h
Watertown, N. Y.	1.00	1.75	1.75	1.50	1.50	1.50
West Chester, Penn.	5.00g	.....	.....	.....	.....	4.00k
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Afton, Mich.	.....	.....	.....	.....	.50	1.50
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Columbia and Krause, Ill.	1.05–1.40	.95–1.50	1.15–1.50	1.05–1.50	1.05–1.50	.....
Cypress, Ill.	1.00–1.25	1.00–1.25	1.20–1.25	1.20–1.25	1.20–1.25	1.35
Davenport, Iowa (f)	1.00	1.50	1.50	1.30	1.30	1.40
Dubuque, Iowa	.85	1.00	.....	1.10	1.10	1.10
Stolle and Falling Springs, Ill.	1.05–1.40	.95–1.50	1.15–1.50	1.05–1.50	1.05–1.50	.....
Greencastle, Ind.	1.25	1.05	1.05	.95	.95	.95
Lannon, Wis.	1.00	1.00	1.00	.90	.90	.90
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Marblehead, Ohio (l)	.55	.80	.80	.80	.80	.80
Milltown, Ind.	.....	.90–1.00	1.00–1.10	.90–1.00	.85– .90	.85– .90
Northern Ohio points	.85–1.15	1.25	1.15	1.15	1.15	1.15
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	1.10
Stone City, Iowa	.75	.....	1.20	1.10	1.00	.....
Thornton, Ill.	.90	1.00	1.25	1.25	1.25	1.25
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Canada (m)	2.50	3.00	3.00	2.85	2.85	2.85
Valmeyer, Ill. (fluxing limestone)	.90–1.20	.....	.....	1.75	.....	1.75
Waukesha, Wis.	.....	.90	.90	.90	.90	.90
Winona, Minn.	1.00	1.20	1.30	1.40	1.40	1.40
Wisconsin points	.50	.....	1.00	.90	.90	.....
Youngstown, Ohio	.70j	1.25l–1.35h	1.25l–1.35h	1.25l–1.35h	1.25l–1.35h	1.25l–1.35h
SOUTHERN:						
Cartersville, Ga.	1.20	1.65	1.65	1.45	1.15	1.15
Chico, Texas	.50–1.00	1.20–1.30	1.15–1.25	1.10	1.00	.95
Cutler, Fla.	.50– .60r	.....	.....	1.75r	1.10–1.50r	.....
El Paso, Texas	.75–1.00	1.00–1.25	1.00–1.25	1.00	1.00	1.00
Graystone, Ala.			Crusher run, screened, $1 per ton			
Olive Hill, Ky.	1.00	1.00	1.00	.90	.90	.90
Rocky Point, Va.	.50– .75	1.40–1.60	1.30–1.40	1.15–1.25	1.10–1.20	1.00–1.05
WESTERN:						
Atchison, Kan.	.50	1.80	1.80	1.80	1.80	1.80
Blue Springs and Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	.....	1.25	1.25	1.00	.....
Rock Hill, St. Louis, Mo.	1.00	1.25	1.25	.90–1.25	.90–1.25	.90–1.25
Sugar Creek, Mo.	.75	1.00	1.20	1.20	1.20	1.20

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Birdsboro, Penn. (q)	1.20	1.60	1.45	1.35	.....	1.30
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Tex.	2.50	2.25	1.75	1.25	1.25	1.25
New Britain, Plainville, Rocky Hill, Wallingford, Meriden, Mt. Carmel, Conn.	.80	1.70	1.45	1.20	1.05	.....
Northern New Jersey	1.35–1.40	2.00–2.10	1.80–1.90	1.40–1.50	1.40–1.50	.....
Richmond, Calif.	.75	.....	1.00	1.00	1.00	.....
Spring Valley, Calif.	.90–1.25	.90–1.25	.90–1.25	.90–1.25	.90–1.25	.90–1.25
Springfield, N. J.	1.40	2.00	1.90	1.50	1.50	.....
Toronto, Canada (m)	.....	5.80	.....	4.05	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Cayce, S. C.—Granite	.....	.....	1.75	1.75	1.60	.....
Eastern Pennsylvania—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Pennsylvania—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.—Flint rock	1.00	.....	2.35	.....	.....	.....
Lithonia, Ga.—Granite	.75a	1.75b	1.60	1.40	1.25	1.25
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.	3.00–3.50	.....	2.00–2.25	2.00–2.25	.....	1.25–3.00
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Somerset, Penn. (sand-rock)			1.50 to 1.85			
Toccoa, Ga.	1.40	1.40	1.40	1.30	1.25	1.25

(a) Sand. (b) to ¼ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Price net after 10c cash discount deducted. (f) 1 in. to ¼ in., 1.45; 2 in. to ¾ in., 1.35. High calcite fluxing stone, 1.50. (g) Run of quarry. (h) Less 10c discount. (i) Less 10% net ton. (k) Rubble stone. (l) Less .05. (m) Plus .25 per ton for winter delivery. (n) Crusher run for ballast, .85. (p) Carload prices. (q) Crusher run, 1.40; ¼-in. granolithic finish, 3.00. (r) Cubic yard.

Agricultural Limestone

(Pulverized)

Alton, Ill.—Analysis, 98% $CaCO_3$, 0.01% $MgCO_3$; 90% thru 100 mesh 6.00

Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh 1.50

Blackwater, Mo.—100% thru 4 mesh 1.00

Branchton, Penn.—Analysis, 94.89% $CaCO_3$; 1.5% $MgCO_3$; 50% thru 100 mesh 3.50–5.00

Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 90% thru 50 mesh 1.50

Cartersville, Ga.—50% thru 50 mesh 1.50
Pulverized, per ton 2.00

Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk 2.50

Cypress, Ill.—Analysis, 88% $CaCO_3$; 10% $MgCO_3$; 50-90% thru 4 mesh 1.25
50-90% thru 100 mesh 1.35

Danbury, Conn., and West Stockbridge, Mass.—Analysis, 90% $CaCO_3$; 5% $MgCO_3$; fine ground, 90% thru 100 mesh; bulk 3.50
Paper bags 4.75
100-lb. cloth bags 5.25
(All prices less .25 cash 15 days)

Davenport, Ia.—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 90% thru 200 mesh, bags, per ton 6.00
90% thru 20 mesh, bulk, per ton 1.50

Hillsville, Penn.—Analysis, 94% $CaCO_3$; 1.40% $MgCO_3$; 75% thru 100 mesh; sacked 5.00

Hot Springs and Greensboro, N. C.—Analysis, $CaCO_3$, 98-99%; $MgCO_3$, 42%; pulverized; 67% thru 200 mesh; bags 3.95
Bulk 2.70

Jamesville, N. Y.—Analysis, 89% $CaCO_3$, 4% $MgCO_3$; pulverized; bags, 4.25; bulk 2.75

Joliet, Ill.—Analysis, 52% $CaCO_3$; 42% $MgCO_3$; 50% thru 200 mesh 2.50

Knoxville, Tenn.—80% thru 100 mesh; bags, 3.95; bulk 2.70

Marlbrook, Va.—Analysis, 80% $CaCO_3$; 10% $MgCO_3$; bulk 1.75
Marl—Analysis, 95% $CaCO_3$; 0% $MgCO_3$; bulk 2.25

Marion, Va.—Analysis, 90% $CaCO_3$, 2% $MgCO_3$; per ton 2.00

Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh; bulk, 2.75; paper bags 4.25

Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk 1.35–1.60

Olive Hill, Ky.—50% thru 4 mesh 1.00

Piqua, Ohio—Total neutralizing power 101.12%; 99% thru 10, 60% thru 50; 45% thru 100 ..... 2.50
100% thru 10, 90% thru 50, 70% thru 100; bags, 5.00; bulk 3.50
100% thru 4, 30% thru 100, bulk 1.50

Rocky Point, Va.—Analysis, $CaCO_3$, 97%; $MgCO_3$, 75%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk 2.00

Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk 2.50

Agricultural Limestone

(Crushed)

Bedford, Ind.—Analysis, 98% $CaCO_3$; 1%, $MgCO_3$; 90% thru 10 mesh 1.50

(Continued on next page)

Agricultural Limestone

Chico and Bridgeport, Tex. — Analysis, 95% $CaCO_3$; 1.3% $MgCO_3$; 50% thru 4 mesh 1.00

Davenport, Ia.—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 90% thru 10 mesh, per ton 1.25
90% thru 4 mesh, per ton 1.10

Dubuque, Iowa—Analysis, 54.96 $CaCO_3$; 38.82 $MgCO_3$; 50% thru 100 mesh ..... .85

Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh 1.00

Ft. Spring, W. Va. — Analysis, 90% $CaCO_3$; 90% thru 50 mesh 1.00

Kansas City, Mo.—50% thru 100 mesh 1.00

Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh 2.00
Screenings (¼ in. to dust) 1.00

Marblehead, Ohio—90% thru 100 mesh 3.00
90% thru 50 mesh 2.00
90% thru 4 mesh 1.00

McCook, Ill.—90% thru 4 mesh ..... .90

Middlepoint, Bellevue, Bloomville, Kenton and Whitehouse, Ohio; Monroe, Mich.; Bluffton, Greencastle and Logansport, Ind.—85% thru 10 mesh, 20% thru 100 mesh 1.50

Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh 1.50

Mountville, Va. — Analysis, 76.60% $CaCO_3$; $MgCO_3$, 22.83%, 100% thru 20 mesh; 50% thru 100 mesh, paper bags, 4.50; burlap bags 5.00

Stolle and Falling Springs, Ill.—Analysis, 89.9% $CaCO_3$, 3.8% $MgCO_3$; 90% thru 4 mesh 1.10–1.70

Stone City, Iowa — Analysis, 98% $CaCO_3$; 50% thru 50 mesh ..... .75

Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh 2.15

Valmeyer, Ill.—Analysis, 96% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh 1.10–1.70

Pulverized Limestone for Coal Operators

Davenport, Ia.—Analysis 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; paper sacks 6.00

Hillsville, Penn., sacks, 4.50; bulk 3.00

Joliet, Ill.—Analysis, 52% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh; paper bags (bags extra) 3.50

Marblehead, Ohio — Analysis, 83.54% $CaCO_3$; 14.92% $MgCO_3$; 99.8% thru 100 mesh; sacks 4.25

Piqua, Ohio, sacks, 4.50-5.00; bulk 3.00–3.50

Rocky Point, Va.—85% thru 200 mesh, bulk 2.25–3.50

Waukesha, Wis.—90% thru 100 mesh, bulk 4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Cedarville and S. Vineland, N. J. *1.75–2.25
Estill Springs and Sewanee, Tenn. 1.50
Franklin, Penn. 2.00
Klondike, Mo. 2.00
Massillon, Ohio 3.00
Michigan City, Ind. ..... .30– .35
Ohlton, Ohio 2.50
Ottawa, Ill. 1.25
Red Wing, Minn. 1.50
Rockwood, Mich. 2.25–3.00
San Francisco, Calif. 4.00–5.00
Silica and Mendota, Va. 2.00
St. Louis, Mo. 2.00
Utica and Ottawa, Ill. 75–1.00
Zanesville, Ohio 2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.50
Dresden, Ohio		1.25
Eau Claire, Wis.	4.25	1.00
Estill Springs and Sewanee, Tenn.	1.35–1.50	1.35–1.50
Franklin, Penn.		1.75
Massillon, Ohio		2.00
Michigan City, Ind.		.30
Montoursville, Penn.		1.25
Ohlton, Ohio	2.00	1.75
Ottawa, Ill.	1.25	1.25
Red Wing, Minn.		1.00
San Francisco, Calif.	3.50	3.50
Silica, Va.		1.75

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Asbury Park, Farmingdale, Spring Lake and Wayside, N. J.		.55	1.10	1.25	1.40	
Attica and Franklinville, N. Y.	.85	.85	.85	.85	.85	.85
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	1.05	1.05	1.05	1.05	1.05
Erie, Penn.	.60	.80		1.40		
Leeds Junction, Me.		.50	1.75		1.25	1.00
Machias Jct., N. Y.	.75	.65	.65	.65	.65	.65
Milton, N. H.		.50				.90
Montoursville, Penn.	1.00	.75– .85	1.00	.90	.80	.80
Northern New Jersey	.50– .60	.50– .60	1.25	1.35	1.25	
Somerset, Penn.		2.00				
South Portland, Me.		1.00	2.50		2.25	
Troy, N. Y.	.50– .75*	.50– .75*	.80–1.00*	.80–1.00*		.80–1.00*
F. o. b. boat, per yd.	1.50	1.50	1.75	1.75		1.75
Washington, D. C.	55	.55	1.20	1.20	1.00	1.00
CENTRAL:						
Algonquin, Ill.	.40*	.20*	.20*	.30*	.35*	.40*
Attica, Ind.			All sizes .75–.85			
Aurora, Moronts, Oregon, Sheridan, Yorkville, Ill.	.50	.35	.20	.50	.60	.60
Barton, Wis.		.40s		.65s	.65s	.65s
Chicago, Ill.	.50	.50–1.45n	.60	.60–1.55n	.60	.60–1.90n
Chicago, Ill.	.30	.20	.30	.40	.40	.45
Columbus, Ohio		.65	.50	.65	.65	
Des Moines, Iowa		.30		1.40	1.50	
Eau Claire, Chippewa Falls, Wis.	.40	.40	.55	.85	.85	
Elkhart Lake, Wis.	.60	.40	.60	.55	.45	.45
Ferrysburg, Mich.		.50– .80	.60–1.00	.60–1.00		.50–1.25
Grand Haven, Mich.		.60– .80	.70– .90	.70– .90		.70– .90
Grand Rapids, Mich.	.50	.50	.90	.80	.70	.70
Hamilton, Ohio		1.00	1.00		1.00	
Hersey, Mich.		.50			.70	.70
Humboldt, Iowa	.35	.35	1.35	1.35	1.35	1.35
Indianapolis, Ind.	.60	.60		.90	.75–1.00	.75–1.00
Mankato, Minn.		.45g		.60–1.25h	.70–1.25	1.25c
Mason City, Iowa		.50	.85	1.25	1.25	1.25
Mattoon, Ill.			.75–.85 all sizes			
Milwaukee, Wis.	.96	.91	1.06	1.06	1.06	1.06
Minneapolis, Minn.	.35p	.35n	1.25q	1.25q	1.25q	1.25q
St. Louis, Mo.	1.15e	1.45f	1.45a	1.45	1.45	1.45
St. Louis, Mo.			†1.45t	†1.45u	†1.65v	†1.65
St. Paul, Minn.	.35	.35		1.25	1.25	1.25
Terre Haute, Ind.	.75	.60	.75	.85	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.10	1.10
SOUTHERN:						
Brewster, Fla.	.50	.50				
Brookhaven, Miss.	1.25	.70	1.25	1.00	.70	.70
Charleston, W. Va.			River sand and gravel, all sizes, 1.40			
Eustis, Fla.		.45– .50				
Ft. Worth, Texas	1.00–1.25	1.00–1.10	1.00–1.25	1.00–1.25	1.00–1.10	1.00
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.00
Macon, Ga.	.65– .90	.65– .90	2.25–2.50	2.25–2.50	2.25–2.50	2.25–2.50
New Martinsville, W. Va.	1.10	1.00		1.30	1.10	.90
Roseland, La.	.30	.30	1.00	.95	.70	.70
WESTERN:						
Kansas City, Mo.	.70– .80	.70– .75				
Crushton, Durbin, Kincaid, Largo, Rivas, Calif.	.10– .40	.10– .40	.50–1.00	.50–1.00	.50–1.00	.50–1.00
Oregon City, Ore.			All grades range from 1.00 to 1.25 per cu. yd.			
Otay, Calif.		.35– .40	.50– .60	.50– .60	.50– .60	.50– .60
Phoenix, Ariz. (k)	1.25*	1.15*	1.50*	1.15*	1.15*	1.00*
Pueblo, Colo.	.70	.60		1.25		1.15
Seattle, Wash.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*
Steilacoom, Wash.	.50	.50	.50	.50	.50	.50

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			.30			
Brookhaven, Miss.						.60
Buffalo, N. Y.	1.10	.95		.85		.85
Burnside, Conn.	.75*					
Chicago, Ill.	1.25m			.35		
Des Moines, Iowa				.60		
Dresden, Ohio				.70	.65	
Eau Claire, Chippewa Falls, Wis.					.65	
Fort Worth, Texas						.70r
Gainesville, Tex.					.55	
Grand Rapids, Mich.				.50		
Hamilton, Ohio					1.00	
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Macon, Ga.	.35					
Oregon City, Ore.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*
Somerset, Penn.		1.85–2.00		1.50–1.75		
Steilacoom, Wash.	.25					
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.40	.40	1.50	1.25	1.10	1.10
York, Penn.	1.10	1.00				

*Cubic yd. ‡Delivered on job by truck. (a) ⅝-in. down. (b) River run. (c) 2½-in. and less. ¶By truck only. (d) Delivered in Hartford, Conn., $1.50 per yd. (e) Mississippi River. (f) Meramee River. (g) Washed and screened river sand. (h) ¾-in. to ¼-in. (j) Lake sand, 1.75, delivered. (k) 60-70% crushed boulders. (m) Cu. yd., dune sand, f.o.b. cars, Chicago. (n) Cu yd., f.o.b. cars, Chicago. (p) .65 cu. yd. (q) $1.75 to $2.00 cu. yd. (r) Pit run. (s) Plus 15c for winter loading. (t) Fine and regular binder. (u) Coarse, torpedo, also roofing. (v) Coarse binder. †2% discount if paid by 15th of month following delivery.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.75	2.65	2.75			4.00	
Beach City, Ohio	1.75–2.00	1.75–2.00		1.50	1.75		
Dresden, Ohio	1.25–1.50	1.25–1.50	1.50–1.75	1.00–1.25			
Eau Claire, Wis.						3.25–4.25	
Elco and Murphysboro, Ill.	Ground silica per ton in carloads—18.00–31.00						
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35–1.50	
Franklin, Penn.	1.75–2.25	1.50–1.75		1.75			
Kasota, Minn.							1.00
Kerrs, Ohio	1.10–1.50	1.25–2.00	2.00			2.75–3.00	
Klondike, Mo.	2.00			2.00			
Massillon, Ohio	2.25	2.25		2.25	2.50		
Michigan City, Ind.				.30–.35			
Montoursville, Penn.				1.50–1.60			
New Lexington, Ohio	2.00	1.50					
Ohlton, Ohio	1.75	1.75		2.00	1.75	1.75	
Ottawa, Ill.	1.25	2.25	2.25	2.25	1.25	3.50	2.00
Red Wing, Minn. (d)					1.50	3.00	1.50
San Francisco, Calif.[1]	3.50†	5.00†	3.50†	3.50–5.00†	3.50–5.00†	3.50–5.00†	
Silica, Mendota, Va.	Potters flint, 8.00–10.00g						
Utica and Ottawa, Ill.	.40–1.00f	.40–1.00f	.75–1.00	.40–1.00f	.60–1.00f	2.23–3.25	1.00–3.25
Utica, Ill.	.60	.70		.75	1.00		
Warwick, Ohio	1.50*–2.00h	1.50*–2.00h		1.50*–2.00h			
Zanesville, Ohio	2.00	1.50	2.00	2.50	2.00		

*Green. †Fresh water washed, steam dried. [1]Core, washed and dried, 2.50. (d) Filter sand, 3.00. (e) Filter sand, 3.00–4.25. (f) Crude and dry. (g) Also 7.00; building sand, 1.75–2.00. (h) Washed, 1.75.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Erie and Dubois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern New Jersey	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Penn.	2.00	1.00		1.25			
Western Pennsylvania	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*	1.80*	1.45*	1.45*	1.45*	
Jackson, Ohio	2.05*	1.05*	1.80*	1.30*	1.05*	1.30*	
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
SOUTHERN:							
Ashland, Ky.	2.05*	1.45*	1.45*	1.45*	1.45*	1.45*	
Ensley and Alabama City, Ala.	2.05	.55	1.25	1.15	.90	.90	.90
Longdale, Roanoke, Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.†		.50*		1.15*	.90*	.90*	

5c per ton discount on terms. †1¼ in. to ¼ in., $1.05; ⅝ in. to 10 mesh, $1.25*; ⅝ in. to 0 in., .90*; ¼ in. to 10 mesh, .80*.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.00
Buffalo, N. Y.	11.50	7.50	7.50	12.00	8.00	11.00	7.50	1.50[16]
Lime Ridge, Penn.							5.00	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00[12]
Williamsport, Penn.	10.00–11.00	8.50–9.00	8.50–9.00		7.00	9.00	5.00	
York, Penn., & Oranda, Va.	11.50[7]	8.50–9.50[7]	8.50–9.50[7]	8.50–10.50[7]	8.00	9.25	7.00	1.40[5]
CENTRAL:								
Afton, Mich.						10.00	7.50	
Carey, Ohio	11.50	7.50	7.50		8.00		8.00	
Cold Springs, Ohio		7.50	7.50				7.00	
Gibsonburg, Ohio	11.50				8.00	10.00		
Huntington, Ind.	11.50	7.50	7.50	12.00	8.00	11.00	7.50	1.50[16]
Luckey, Ohio	11.50							
Milltown, Ind.		8.50–10.00		10.00[8]			8.50[22]	1.35[10]
Ohio points	11.50	7.50	7.50	12.00	8.00	11.00	7.50	1.50[16]
Scioto, Ohio	11.50	7.00	7.00	8.00	8.25	.62½	7.00	1.50
Sheboygan, Wis.		10.50					9.50	2.00[4]
Wisconsin points[6]		11.50					9.50	
Woodville, Ohio	11.50	7.50	7.50	12.50	8.00	10.00[9]	8.00	1.50[3]
SOUTHERN:								
El Paso, Texas							7.00	1.50
Frederick, Md.		8.00–9.50	8.00–9.50			9.50[15]	7.00[15]	
Graystone & Landmark, Ala.	12.50	9.00		12.50			7.00	1.35
Keystone, Ala.	19.00	9.00	9.00	9.00			7.50	1.35
Knoxville, Tenn.	19.00	9.00	9.00	9.00			7.50	1.35
Ocala, Fla.	14.00	11.00	11.00	14.00				.65[10]
WESTERN:								
Kirtland, N. M.							15.00	
Los Angeles, Calif.	15.00	14.00	12.00	18.00			13.50	
San Francisco, Calif.	19.00–19.50	16.00–17.50	12.50–13.70	19.00	13.00[19]	.90[17]	13.00[19]	1.85[17]
Tehachapi, Calif.[13]	10.80		6.75[11]	12.00			10.30	
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

[1] Barrels. [2] Net ton. [3] Wooden, steel 1.70. [4] Steel; in bbl. .95. [5] Dealers' prices, net 30 days less 25c discount per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days. [7] In paper bags, including bags. [8] To 11.00. [9] 80-lb. [10] To 1.50. [11] Refuse or air slack, 10.00–12.00. [12] To 3.00. [13] Delivered in Southern California. [15] To 8.00. [16] to 1.70. [17] Less credit for return of empties [18] 90-lb. sacks. [19] Also 14.50. [22] To 9.00. [30] To 16.50.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Utica and Ottawa, Ill.	1.00–3.25	.75
Warwick, Ohio		2.00
Zanesville, Ohio		2.50

*Damp.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chatsworth, Ga.:
- Crude talc (for grinding) 4.00–50.00
- Ground talc (20-50 mesh), bags 8.00
- Ground talc (150-200 mesh), bags 8.50–15.50
- Pencils and steel crayons, gross 1.00–2.00

Chester, Vt.:
- Ground talc (150-200 mesh), paper bags 7.50–8.50a
- Same, including 50-lb. bags 8.50–9.50

Chicago and Joliet, Ill.:
- Ground (150-200 mesh), bags 30.00

Cromleys Mt., Md.:
- Crude talc 63.00

Dalton, Ga.:
- Crude talc (for grinding) 4.00
- Ground talc (150-200 mesh), bags 9.00
- Pencils and steel worker's crayons, per gross 1.00–2.00

Emeryville, N. Y.:
(Double air floated) including bags:
- 325 mesh 14.75
- 200 mesh 13.75

Hailesboro, N. Y.:
- Ground white talc (double and triple air floated) 200-lb. bags, 300-350-mesh 15.50–20.00

Henry, Va.:
- Crude (mine run) 3.50–4.50
- Ground talc (150-200 mesh), bags 8.75–14.00

Joliet, Ill.:
Ground talc (200 mesh) in bags:
- California white 30.00
- Southern white 20.00
- Illinois talc 10.00
- Crude talc 3.75

Keeler, Calif.:
- Ground (200-300 mesh), bags 20.00–30.00

Natural Bridge, N. Y.:
- Ground talc (300-325 mesh), bags 12.00–15.00

(a) Bags extra.

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

- Columbia, Tenn.—B.P.L. 65-70% 3.50–4.50
- Gordonsburg, Tenn.—B.P.L. 65-70% 4.25–4.75
- Mt. Pleasant, Tenn.—B.P.L. 78% 6.50–6.75
- Tennessee — F.o.b. mines, gross ton, unground brown rock, B.P.L. 72% 5.00
- B.P.L. 75% 6.00
- Twomey, Tenn.—B.P.L. 65%, 2000 lb. 8.00–9.00

Ground Rock
(2000 lb.)

- Centerville, Tenn.—B.P.L. 65% 8.00
- Gordonsburg, Tenn.—B.P.L. 68% 4.00
- B.P.L. 72% 4.50
- Mt. Pleasant, Tenn.—Lime phosphate: B.P.L. 73% to 75%, 98% thru 100 mesh, bags extra 11.70
- 80-85% thru 300 mesh, bags extra 11.80
- Twomey, Tenn.—B.P.L. 65% 8.00
- Wales, Tenn.—B.P.L. 65% 11.00

Florida Phosphate

(Raw Land Pebble)
(Per Ton)

- Florida—F.o.b. mines, gross ton, 68/66% B.P.L., Basis 68% 3.25
- 70% min. B.P.L., Basis 70% 3.75

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

- New York City, N. Y.—Per lb., Cut mica (1½x2) 1.60
- Cut mica (8x10) 26.00
- Pringle, S. D.—Mine run, per ton 125.00
- Punch mica, per lb. .06
- Scrap, per ton, carloads 20.00
- Rumney Depot, N. H.—Per ton, Mine run 300.00
- Clean shop scrap 25.00
- Mine scrap 22.50–24.00
- Roofing mica 37.50
- Punch mica, per lb. .12
- Cut mica—50% iron Standard List.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, English cream and coral pink	¶12.50–‖14.50	¶12.50–‖14.50
Brighton, Tenn.—Pink marble chips	§3.00	§3.00
Crown Point, N. Y.—Mica spar		9.00–10.00
Davenport, Ia.—White limestone, in bags	6.00	6.00
Easton, Penn.		8.00– 9.00
Harrisonburg, Va. — Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash		11.00–18.00
Middlebrook, Mo.—Red		20.00–25.00
Middlebury, Vt. — Middlebury white	10.00	10.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		5.50– 7.50
Phillipsburg, N. J.—Royal green granite		15.00–18.00
Randville, Mich.—Crystalite white marble, bulk	4.00	4.00– 7.00
Rose pink granite, bulk		12.00
Stockton, Calif.—"Nat-rock" roofing grits		12.00–20.00
Tuckahoe, N. Y.—Tuckahoe white	8.00	
Warren, N. H.		¶7.90–‖8.95
Wauwatosa, Wis.		20.00–32.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00
Whitestone, Ga.		*10.00

†C.L.; L.C.L. 16.00. ¶C.L. ‖L.C.L. (a) Including bags. *Per 100 lb.

Potash Feldspar

Auburn and Topsham, Me.—Color white, 98% thru 140-mesh	19.00
Buckingham, Ore. — White, analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y. — Color, white; analysis, K_2O, 9.63%; Na_2O, 1.01%; SiO_2, 69.72%; Fe_2O_3, .00%; Al_2O_3, 18.6%; bulk (crude)	9.00
East Hartford, Conn. — Color, white, 40 mesh to 200 mesh	15.00–28.00
East Liverpool, Ohio — Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Glen Tay Station, Ont.—Color, red or pink; analysis, K_2O, 12.81%; crude	7.00
Keystone, S. D.—White; bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 12.16%; Na_2O, 1.53%; SiO_2, 65.60%; Fe_2O_3, .10%; Al_2O_3, 19.20%; Arizona spar, crude, bags, 12.50–14.00; bulk	11.00–12.50
Pulverized, 95% thru 200 mesh; bags, 19.73–23.50; bulk	15.75–22.50
Pulverized, 20% thru 80 mesh; bags, 17.60; bulk	16.50
Murphysboro, Ill.—Color, prime white; analysis, K_2O, 12.60%; Na_2O, 2.35%; SiO_2, 63%; Fe_2O_3, .06%; Al_2O_3, 18.20%; 98% thru 200 mesh; bags, 21.00; bulk	20.00
Penland, N. C.—White; crude, bulk	8.00
Ground, bulk	16.50
Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 68%; Fe_2O_3, 0.10%; Al_2O_3, 18%; 99½% thru 200 mesh; bulk (Bags 15c extra.)	18.00
Crude feldspar, bulk	12.00
Tennessee Mills—Color, white; analysis, K_2O, 10%; Na_2O_3, 3%; SiO_2, 68%; 99½% thru 200 mesh; bulk (Bags, 15c extra)	18.00
Toronto, Can.—Colo, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50– 8.00

Chicken Grits

Afton, Mich.—(Limestone), per ton	1.75
Belfast, Me.—(Limestone), per ton	‡10.00
Chico and Bridgeport, Tex.	12.00
Danbury, Conn.; Adams, Ashley Falls, and West Stockbridge, Mass.—(Limestone)	‡7.50–*9.00
Davenport, Ia.—(Limestone), bags, per ton	6.00
Easton, Penn.—In bags	8.00
El Paso, Tex.—Per ton	1.00
Knoxville, Tenn.—Per bag	1.25
Los Angeles, Calif.—Per ton, including sacks:	
Feldspar	14.00
Gypsum	7.50
Marion, Va.—(Limestone), bulk, 5.00; bagged, 6.50; 100-lb. bag	.50
Middlebury, Vt.—Per ton (a)	10.00
Randville, Mich.—(Marble), bulk	6.00
Rocky Point, Va.—(Limestone), 100-lb. bags, 50c; sacks, per ton, 6.00; bulk	5.00
Seattle, Wash.—(Gypsum), bulk, per ton	10.00
Tuckahoe, N. Y.	8.00
Waukesha, Wis.—(Limestone), per ton	7.00
Wisconsin Points—(Limestone), per ton	15.00
Winona, Minn.—(Limestone), sacked, per ton, 8.00; bulk, per ton	6.00

*L.C.L. †Less than 5-ton lots. ‡C.L. ¶100-lb. bags. (a) F.o.b. Middlebury, Vt.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	11.00
Anaheim, Calif.	10.50–11.00
Barton, Wis.	10.50g
Boston, Mass.	17.00*
Brighton, N. Y.	19.75*
Brownstone, Penn.	11.00
Dayton, Ohio	12.50–13.50
Detroit, Mich.	13.00–16.00*d
Farmington, Conn.	13.00
Flint, Mich.	18.00†
Grand Rapids, Mich.	12.50
Hartford, Conn.	14.00–19.00*
Jackson, Mich.	13.00
Lakeland, Fla.	10.00–11.00
Lake Helen, Fla.	9.00–12.00
Lancaster, N. Y.	12.25
Madison, Wis.	12.50a
Mishawaka, Ind.	11.00
Milwaukee, Wis.	13.00*
Minneapolis, Minn.	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	12.50–15.00*
Pontiac, Mich.	15.50
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00–22.50
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas (h)	12.50–13.00
Sebewaing, Mich.	12.50
Sioux Falls, S. Dak.	13.00
South River, N. J.	13.00
Syracuse, N. Y.	18.00–20.00
Toronto, Canada (f)	15.00†e
Wilkinson, Fla.	12.00–16.00
Winnipeg, Canada	15.00

*Delivered on job. †5% disc. 10 days. ‖Dealers' price. (a) Less 50c disc. per M, 10th of month. (d) 5% disc., 10th of month. (e) Delivered in city limits. (f) F.o.b. yard, 12.50. (g) Delivered Milwaukee, 13.00. (h) Delivered in city, 14.00–15.00.

Portland Cement

	Per Bag	Per Bbl.	High Early Strength
Atlanta, Ga.		2.36	3.61¶
Baltimore, Md.		2.25–2.65	3.55¶
Birmingham, Ala.		2.00	3.54¶
Boston, Mass.	.68¼	2.33–2.73e	3.27¶
Buffalo, N. Y.	.62½	2.10–2.50	3.40¶
Butte, Mont.	.90¼	3.61	
Cedar Rapids, Iowa		2.24	
Charleston, S. C.		2.25d	3.58¶
Cheyenne, Wyo.	.64	2.56	
Chicago, Ill.		2.05–2.45	3.35¶
Cincinnati, Ohio		2.22–2.62	3.52¶
Cleveland, Ohio		2.24–2.64	3.54¶
Columbus, Ohio		2.22–2.62	3.53¶
Dallas, Texas		1.80	3.29¶
Davenport, Iowa		2.24	
Dayton, Ohio		2.24–2.64	3.54¶
Denver, Colo.	.63¾	2.55	
Des Moines, Iowa		2.14	
Detroit, Mich.		1.95	3.27¶
Duluth, Minn.		2.04	
Houston, Texas		1.90	3.63¶
Indianapolis, Ind.	.54¾	2.19–2.59	3.49¶
Jacksonville, Fla.		2.60b	3.79¶
Jersey City, N. J.		2.13–2.53	3.43¶
Kansas City, Mo.	.45½	1.82	3.22¶
Los Angeles, Calif.	.62½	2.50	
Louisville, Ky.	.55½	2.57	3.47¶
Memphis, Tenn.		2.04–2.44	3.64¶
Milwaukee, Wis.		2.20–2.60	3.50¶
Minneapolis, Minn.		2.12–2.22	
Montreal, Que.		1.60	
New Orleans, La.	.45½	1.82	3.61¶
New York, N. Y.	.60¾	2.03–2.43	3.33¶
Norfolk, Va.		2.07	3.37¶
Oklahoma City, Okla.	.57¼	2.29	3.69¶
Omaha, Neb.	.54	2.16	3.56¶
Peoria, Ill.		2.22	
Philadelphia, Pa.		2.21–2.61	3.51¶
Phoenix, Ariz.		3.91*	
Pittsburgh, Penn.		2.04	3.34¶
Portland, Ore.‡		2.30–2.90a	
Reno, Nev.‡		3.41a	
Richmond, Va.		2.40–2.80	3.70¶
Salt Lake City, Utah	.70¼	2.81	
San Francisco, Calif.‡		2.71a	
Savannah, Ga.		2.60c	3.65¶
St. Louis, Mo.	.48¾	1.95–2.35	f3.25¶
St. Paul, Minn.		2.12–2.22	
Seattle, Wash.		2.50†	f3.60†
Tampa, Fla.		2.40	4.11¶
Toledo, Ohio		2.20–2.60	3.50¶
Topeka, Kans.	.50¼	2.01	3.41¶
Tulsa, Okla.	.53¼	2.13	3.53¶
Wheeling, W. Va.		2.12–2.52	
Winston-Salem, N. C.		2.29	3.59¶
Mill prices f.o.b. in carload lots, without bags, to contractors.			
Albany, N. Y.	.43¾	1.75	
Bellingham, Wash.		2.10	
Buffington, Ind.		1.80	
Chattanooga, Tenn.		2.45*	
Concrete, Wash.		2.35	
Davenport, Calif.		2.05	
Hannibal, Mo.		1.90	
Hudson, N. Y.		1.75	
Leeds, Ala.		1.65	
Lime and Oswego, Ore.		2.50‡	
Mildred, Kan.		2.35	
Nazareth, Penn.		2.15	
Northampton, Penn.		1.75	
Richard City, Tenn.		2.05	
Steelton, Minn.		1.85	
Toledo, Ohio		2.20	
Universal, Penn.		1.80	

NOTE—Add 40c per bbl. for bags. *Includes sacks. †10c disc., 10 days. ‡10c disc., 15 days. (a) Includes cloth sacks returnable at 10c each. (b) 24c bbl. refund for paid freight bill. (c) 35c bbl. refund for paid freight bill. (d) 40c bbl. refund for paid freight bill. ¶"Incor" Perfected prices per bag in paper sacks. (e) 45c bbl. refund for paid freight bill. (f) "Velo" cement, including cost of paper bag.

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ¼x32x 36". Per M Sq. Ft.	⅜x32x 36". Per M Sq. Ft.	Wallboard. ⅜x32 or 48" Lengths 6'-10'. Per M Sq. Ft.
Acme, Tex.	1.70	4.00	4.00	4.00	4.00	4.50	.....	.....	.....	.....	.....	15.00	20.00
Arden, Nev., and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	.....	.....	.....	.....	11.70u	.....	.....	.....
Blue Rapids, Kan.	1.70	4.00	.....	.....	.....	.....	10.00	.....	.....	.....	.....	15.00	20.00
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50	.....	.....	13.50	.....	.....	.....
Des Moines, Iowa	3.00	8.00	9.00	10.00	10.00	10.50	13.50	12.00	24.00	22.00	18.00	21.00	30.00
Detroit, Mich.	.....	.....	.....	.....	14.30o	12.30m	.....	m9.00–11.00o	.....	.....	.....	.....	.....
Delawanna, N. J.	.....	.....	.....	4.50–5.00	13.10–14.00	5.00	.....	7.25	.....	.....	.....	.....	25.00
Douglas, Ariz.	.....	.....	6.00	14.50	15.00	.....	18.00	.....	30.00	.....	.....	.....	.....
Fort Dodge, Iowa	1.70	4.00	6.00	9.00	9.00	9.50	.....	.....	.....	19.00	.....	15.00	20.00
Grand Rapids, Mich.	2.65	4.00	6.00	6.00	9.00	9.00	17.65	.....	22.75	19.00	12.00	15.00	18.00
Gypsum, Ohio	1.70–3.00	4.00	6.00	7.00–9.00	9.00	9.00	19.00	7.00	24.50	19.00	.....	15.00	20.00–25.00
Los Angeles, Calif.	4.90	7.50m	7.50m	8.40	9.00	.....	10.00	.....	36.00u	9.00	19.00	21.00	27.50
Medicine Lodge, Kan.	1.70	4.00	.....	.....	.....	.....	.....	.....	15.00	.....	.....	15.00	20.00
Oakfield, N. Y.	2.50	.....	.....	5.50	6.00	6.00	.....	5.50	.....	.....	.....	15.00	25.00
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	.....	20.00	30.00
Portland, Colo.	.....	.....	.....	10.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Calif.	.....	.....	9.00	13.40	14.40	.....	15.40	.....	.....	.....	.....	.....	.....
Seattle, Wash.	6.00	10.00m	10.00m	13.00m	14.00m	.....	15.00	.....	.....	15.00	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	.....	.....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) Hardwall plaster, 13.00; casting, finishing molding, 14.00; (b) Calacoustic plaster, 10.00 at mill; (c) Plaster lath; (m) includes paper bags; (o) includes jute sacks; (u) includes sacks; (v) retail 35.00

Market Prices of Cement Products and Slate

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City or shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00	.....	.....
Cement City, Mich.		5x8x12–55.00¶	
Chicago District‖	180.00–210.00a	230.00–260.00a	280.00–330.00a
Columbus, Ohio	16.00	.....	.....
Detroit, Mich.	.15– .17†	.....	.24–.26†
Forest Park, Ill.	21.00*	.....	.....
Grand Rapids, Mich.	15.00*	.....	.....
Graettinger, Iowa	.18– .20	.....	.....
Indianapolis, Ind.	.10– .12a	.....	.....
Los Angeles, Calif.	4x8x12–5.00*	.....	.....
Olivia and Mankato, Minn.	9.50b	.....	.....
Somerset, Penn.	.18– .20	.....	.....
Tiskilwa, Ill.	.16– .18†	.....	.....
Yakima, Wash.	20.00*	.....	.....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton. (c) Plain.

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00– 40.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00– 50.00
Camden & Trenton, N. J.	17.00	.....
Chicago District	14.00	.....
Columbus, Ohio	16.00	17.00
El Paso, Tex.—Klinker	10.00	.....
Ensley, Ala. ("Slagtex")	9.00–12.00	.....
Eugene, Ore.	25.00	35.00– 75.00
Forest Park, Ill.	.....	37.00
Friesland, Wis.	22.00	32.00
Longview, Wash.*	15.00	22.50– 65.00
Los Angeles, Calif.	12.50	.....
Milwaukee, Wis.	14.00	30.00
Mt. Pleasant, N. Y.	.....	14.00– 23.00
Omaha, Neb.	18.00	30.00– 40.00
Pasadena, Calif.	10.00	.....
Philadelphia, Penn.	14.75	.....
Portland, Ore.	17.50	23.00– 55.00
Mantel brick—100.00–150.00		
Prairie du Chien, Wis.	14.00	22.50– 25.00
Rapid City, S. D.	18.00	30.00– 35.00
Waco, Texas	16.50	32.50–125.00
Watertown, N. Y.	20.00	35.00
Westmoreland Wharves, Penn.	14.75	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	.....

*40% off List.

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.:	
Red	15.00
Green	18.00
Chicago, Ill.—Per sq.	20.00
Detroit, Mich.—5x8x12, per M	67.50
Houston, Texas—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60
Pasadena, Calif. (Stone Tile):	
3½x4x12, per 100	3.00
3½x6x12, per 100	4.00
3½x8x12, per 100	5.50
Tiskilwa, Ill.;	
8x8, per 100	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile):	
3½x6x12, per M	50.00
3½x8x12, per M	60.00
Prairie du Chien, Wis.:	
5x8x12, per M	82.00
5x4x12, per M	46.00
5x8x6 (half-tile), per M	41.00
5x8x10 (fractional), per M	82.00
Yakima, Wash. (Building Tile):	Each
5x8x12	.10

Wholesale Prices of Slate

Prices given are f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened 200 mesh, $7.50 per ton in paper bags.

Slate Granules

Esmont, Va.—Blue, $7.50 per ton. Pen Argyl, Penn.—Blue grey, $7.50 per ton.
Granville, N. Y.—Red, green and black, $7.50 per ton.

Roofing Slate

Prices per square—Standard thickness.

City or shipping point:	3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Arvonia, Va.—Oxford gray Buckingham	14.62	18.13	23.40	26.33	32.14	40.95
Bangor, Penn.—No. 1 clear	13.00	22.00	26.00	30.00	40.00	50.00
No. 1 ribbon	9.25	18.00	22.00	26.00	36.00	46.00
Medium clear	9.50	.....	.....	.....	.....	.....
No. 2 ribbon	6.50	.....	.....	.....	.....	.....
Chapman Quarries, Penn.—Hard vein	11.25	22.00	26.00	30.00	40.00	50.00
Hard vein medium	9.00	18.00	22.00	26.00	36.00	46.00
Fairhaven, Vt.—						
Mottled purple and unfading green	21.00	24.00	30.00	36.00	48.00	60.00
Granville, N. Y.—Sea green, weathering	14.00	24.00	30.00	36.00	48.00	60.00
Semi-weathering, green and gray	15.40	24.00	30.00	36.00	48.00	60.00
Mottled purple and unfading green	21.00	24.00	30.00	36.00	48.00	60.00
Red	27.50	33.50	40.00	47.50	62.50	77.50
Monson, Maine	19.80	24.00	.....	.....	.....	.....
Pen Argyl, Penn.—Albion	10.50	22.00	26.00	30.00	40.00	50.00
Albion mediums	9.00	18.00	22.00	26.00	36.00	46.00
Cathedral gray	12.50	22.00	26.00	30.00	40.00	50.00
No. 1 ribbon	8.50	18.00	22.00	26.00	36.00	46.00
Textural	15.00	24.00	30.00	36.00	48.00	60.00
Slatedale and Slatington, Penn.—						
Genuine Franklin	11.25	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1	10.50	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1 clear	9.50	18.00	22.00	26.00	36.00	46.00
Blue Mountain No. 2 clear	8.00	18.00	22.00	26.00	36.00	46.00

(a) Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices.
(b) Prices other than 3/16-in. thickness include nail holes.
(c) Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.

Cement Building Tile

Cement City, Mich.:	
5x8x12, per 100	5.00
Chicago District (Haydite):	
4x 8x16, per 100	14.00
8x 8x16, per 100	22.00
8x12x16, per 100	30.00
Columbus, Ohio:	
5x8x12, per 100	6.50
Detroit, Mich.:	
5½x8x12, per M	75.00
Grand Rapids, Mich.:	
5x8x12, per 100	8.00
Longview, Wash.:	
4x6x12, per 100	5.00
4x8x12, per 100	6.25
Mt. Pleasant, N. Y.:	
5x8x12, per M	78.00
Houston, Texas:	
5x8x12 (Lightweight), per M	80.00

Cement Drain Tile

Graettinger, Iowa.—Drain tile, per foot: 5-in., .04½; 6-in., .05½; 8-in., .09; 10-in., .12½; 12-in., .17½; 15-in., .35; 18-in., .50; 20-in., .60; 24-in., 1.00; 30-in., 1.35; 36-in.	2.00
Longview, Wash.—Drain tile, per foot: 3-in., .05; 4-in., .06; 6-in., .10; 8-in., .15; 10-in.	.20
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile, per 100 ft.	
3-in.	4.00
4-in.	5.00
6-in.	7.50
8-in.	10.00
Waukesha, Wis.—Drain tile, per ton	8.00

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4 in.	6 in.	8-in.	10 in.	12 in.	15-in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Detroit, Mich. (c)																	
Sewer	.10	.12	.22	.30	.40	.60	.90	1.20	.....	1.75	2.00	2.50	3.30	4.50	5.75	6.50	8.00
Culvert	.....	.....	.....	.....	.95	1.25	1.60	.....	.....	2.25	2.50	3.00	3.50	5.00	6.50	8.00	10.00
Grand Rapids, Mich.	4 in. to 12 in., 72% off standard sewer price list; 15 in., 65% off; 18 in. to 24 in., 62% off; 27 in. to 36 in., 60% off																
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	1.70†	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.....	.75	.85	.90	1.15	.....	.....	.....	1.60	.....	2.50	.....	.....	.....	.....
Longview, Wash.	Sewer pipe 40% off list; culvert—list																
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Newark, N. J.	6 in. to 24 in., 18.00 per ton																
Norfolk, Neb. (b)	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Olivia, Mankato, Minn.	12.00 per ton																
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Penn.	.....	.....	.....	.....	1.08	1.25	1.65	.....	.....	2.50	.....	3.65	4.85	7.50	8.50	.....	.....
Tiskilwa, Ill. (rein.)	.....	.....	.....	.75	.85	.95	.70	1.55	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tacoma, Wash.	.15	.17	.22	.30	.40	.55	.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	.95	.....	1.27	.....	.....	2.01	.....	2.73	3.78	4.58	6.24	7.99	8.11
Yakima, Wash.	.....	.....	.....	.....	.....	.....	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78

(a) 24-in. lengths. (b) Reinforced. (c) Delivered on job; 5% discount, 10th of month. †21-in. diameter. ‡Price per 2-ft. length.

Highway Engineers Optimistic On Prospects

AN UNPRECEDENTED BOOM in road building during the next four years was predicted by officers of the American Association of State Highway Officials, which convened recently at Chicago, Ill.

The delegates were told that $10,000,000,000 a year is spent for new automobiles and for maintenance of old ones, and that both the motor cars in this country and miles of paved roads have quadrupled in ten years.

W. C. Markham of Washington, D. C., secretary of the association, declared that the road building program throughout the country would certainly be vastly increased under the next administration because of Mr. Hoover's utterances in regard to roads during the campaign. The road officials viewed the continuance of prosperity as certain to reflect on their business.

The federal appropriation of $83,000,000 should be doubled, and that will probably be asked by resolution by the association, Mr. Markham said. In addition to increased federal aid, the individual states are certain to increase their road funds enormously, he added, citing Iowa's $100,000,000 program and Missouri's $75,000,000 bond issue.

In spite of the increase in paved roads in the last ten years, Mr. Markham said, not more than one-half of the federal highways have hard surfacing. At the present time he said there are 24,000,000 automobiles in the country and 162,000 miles of paved roads.

Frank T. Sheets, Illinois highway engineer and president of the association, declared that the motorists who spend $10,000,000,000 annually demand the best highway system in the world and that the program ahead is to build more paved roads and wider ones to accommodate the ever-increasing traffic.

To meet the demands in the metropolitan areas is a problem that constantly taxes the ability of engineers, for, he said, no sooner do new pavements become travel-stained but they are loaded to capacity. Only the most far-seeing and boldest plans for the future will provide permanence and adequacy, he declared.

Mr. Sheets asserted that commercial vehicles are not bearing their share of the tax load, although they are cutting into the revenues of railroads and that a readjustment of license fees must be had.—*Chicago* (Ill.) *Journal of Commerce.*

Carolinas Big Users of Imported Cement

ALMOST one-fourth of all the cement imported into the United States in the first nine months of this year was received by North Carolina and South Carolina purchasers, according to a report by C. Grant Isaacs, manager of the regional office at Charlotte, N. C., of the Bureau of Foreign and Domestic Commerce.

With the exception of about 30,000 bbl. of Norwegian cement, the bulk of this cement was imported by the Carolinas from Belgium. The total imports of Roman, portland and other hydraulic cements, free and dutiable, for these nine months were 1,833,141 bbl., valued at $2,568,306, or 23% more than the imports of 1,530,812 bbl. for the corresponding months of last year.

Imports in the Carolinas alone amounted to 524,179 bbl., valued at $692,164. Importations by Massachusetts were valued at $564,305.

Belgium was the principal source of supply, furnishing 1,500,000 bbl. of the total imported by the United States in that period, said Mr. Isaacs.—*Charlotte* (N. C.) *News.*

Future of Canada's Asbestos Industry

QUEBEC'S ASBESTOS INDUSTRY need not fear expansion in production from United States mines, granted a fair show by the governments, is the view expressed by W. G. Ross, president and general manager of Asbestos Corp., Ltd., in reply to Dr. R. V. Mattison, president of the Keasbey and Mattison Co., who is attempting to show that Canada is losing ground and will continue to lose ground in the production of the better grade of asbestos. Admitting that Canada is facing growing competition in the crude asbestos market, Mr. Ross points out that development of new uses for the mineral is resulting in a steadily growing world demand which is more than offsetting the growth in production from new sources. An adverse feature of operations here is the high labor costs, which have recently been added to by the new Quebec workmen's compensation act.

New Use of Plastic Waterproof Portland Cement

SHIPMENT of some 100 sacks of plastic waterproof portland cement to the Aleutian Livestock Co. at Dutch Harbor, Alaska, where the product will be used for dampproofing kennels for silver foxes and building water troughs for reindeer, has been reported by officials of the Monolith Portland Cement Co.

Aside from the unusual use to which the cement will be put, the consignment is significant in that it marks the farthest north that the Monolith product has ever been shipped.

Receipt of reports from several Monolith dealers in Tulare county, California, relative to the use of waterproof cement in the cattle raising industry also was announced. Concrete watering troughs for cattle are being built of metal lath and Monolith plastic cement mortar by a number of cattlemen in the foothill districts of the Sierras to replace the ancient wooden troughs, and in many instances hollow logs.

Louisiana Gravel Industry Active and Growing

THREE THOUSAND CARS of commercial gravel were shipped out the first seven months of 1928 from Ouachita parish, Louisiana, gravel pits. More gravel than this was shipped, as the several railroads in this vicinity have been using a large quantity for ballast and general roadbed construction, but the amount above was used solely for commercial sale.

Some of the most valuable gravel pits in the entire South are to be found in Ouachita parish. They are located along the line of the Illinois Central just beyond the city limits of West Monroe.

Development of the pits has been rapid as several years ago there was but one while now there are four. The railroad has constructed extensive sidetrackage for the various companies and the concerns themselves in most cases either own or have leased engines and other railroad equipment that the industry necessitates.

Four Gravel Companies

The Victory Sand and Gravel Co. is located just beyond West Monroe. Its general manager is J. C. Roberts of Shreveport. This is a large and prosperous concern. It was the first to enter the field.

A second gravel pit company is that of the Monroe Sand and Gravel Co. with offices in the Ouachita National Bank building, Monroe. T. E. Stephenson is manager. This company is large and growing. Its extensive pits are two miles out of West Monroe and along the main line of the Illinois Central.

The Parker Sand and Gravel Co. is managed by W. L. Morgan. The pits are at Watts spur, which is four miles out of West Monroe also along the main line of railroad.

The Clements Sand and Gravel Co. is located about three miles west of West Monroe. It is headed by D. T. Clements.

All the sand and gravel shipped from this area goes to towns and cities within a radius of 100 miles from the Twin Cities but none goes to Arkansas or Mississippi from here as to do so would cause interstate complications as to rates and the owners of the pits find sufficient demand for their products near home in their own state.—*Monroe* (La.) *News Star.*

Texas Produces Granite Sawing Sand

LLANO RIVER (Texas) sand, which has long been recognized as unsurpassed for cement and plaster work, is now being used by local granite manufacturers for sand blasting, that heretofore used, having been shipped in from Vermont. It cuts as neat a letter as the New England product, and because of its hard surface, does the work faster.—*Mercedes* (Tex.) *Tribune.*

General Motor Applications Under Dusty Conditions

A Discussion of Some of the Power Problems Which Must Be Met in the Rock Products Field

By A. E. Lapoe
General Engineer, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn.

THE ROCK PRODUCTS INDUSTRY, like other industries, is following the general trend toward electrification. It has been at once recognized that electric power, applied through the electric motor, presents a better solution of the power problems from all standpoints—convenience, cost, maintenance, production, operation, reliability—than any form of power heretofore used. Even in plants where there is a by-product use for steam, as in the lime industry, the steam engine has been superseded by the more satisfactory electric motor. Attention now should be directed towards getting more and better service from the motors of today than could be obtained from the motors of ten years ago.

More than the single consideration of driving torque or turning effort should be considered in the installation of electric motor drives. Torque is the prime requirement because a motor, first of all, must start and drive its connected load, but other factors, also, have a direct bearing on the degree of service that a motor can render. Just as certain mixtures of ingredients and methods of treatment produce cements of various qualities, so do various factors affect motor performance, even though the motor may still be capable of driving its load. It is well worth while, when installing a motor drive, to give careful attention to such matters as the characteristics of the connected load, and, therefore, the characteristics of the motor and control combination best fitted for the application. In addition to the operating characteristics, such as torque, efficiency and power factor, the inherent qualities of the materials built into the motor, and the engineering and constructive skill used in the design and assembly, merit careful consideration. Generally speaking, present-day competition is a millstone which grinds out approximately the same dollar's worth to all motor purchasers. However, certain progressive manufacturers can offer more than the average dollar's worth by incorporating into their product improvements and refinements which are the results of elaborate research and years of experience recorded in carefully kept files.

Advantages of the Squirrel-Cage Motor

In the industrial field today, the squirrel-cage induction motor predominates. An inspection of its construction immediately explains its well deserved popularity. Such factors as indestructible rotors, maintenance-free stators, and simple control, coupled with the utmost reliability and the minimum investment, offer an unbeatable combination. It is only where the characteristics of the load are such that the squirrel-cage motor will not serve, that we find motors of other types installed. The one exception to this statement is the case of the synchronous motor, with its rapidly spreading field of application due to its excellent torque and power factor characteristics. However, the synchronous motor is not so readily adapted for most plant drives on account of the definite maximum economic limit in minimum size which exists.

One part of all motors, and practically the

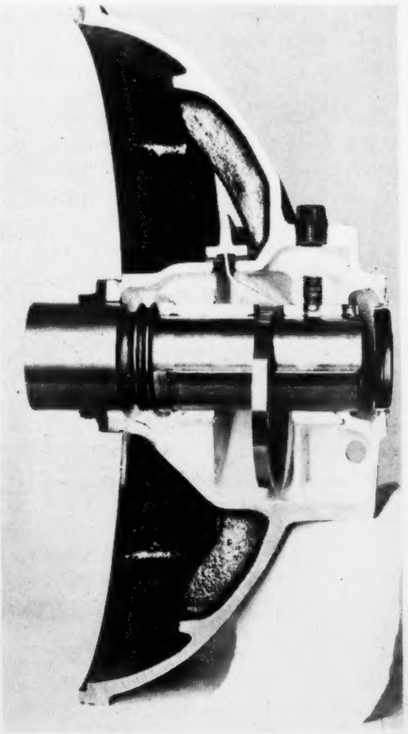


Fig. 1. Section through the sealed-sleeve bearing on a dust-tight motor

Fig. 2. A standard sealed-sleeve bearing motor equipped with a blower was run in this locked box, containing six sacks of loose cement, for 214 days

only part of squirrel-cage motors, which requires attention and maintenance are the bearings. Considerable attention and effort should, therefore, be directed towards providing this motor with the best possible bearings. Unfortunately the character of a bearing, involving, as it does, moving parts and a lubricating medium, places a limit

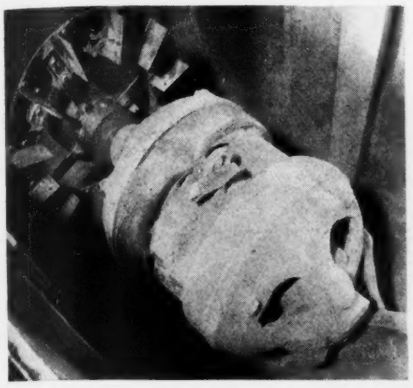


Fig. 3. A standard motor, equipped with sealed-sleeve bearings and driving a blower

upon the degree of perfection that can be attained. The bearings of a motor must not only support the rapidly moving rotor in a fixed position with respect to the stator, but they must effectively retain within its housing the lubricant, and just as effectively exclude from its housing all foreign material.

Sleeve Bearings

An equal air gap all the way around the periphery of the rotor is a rigid requirement of all electric motors; and it is therefore essential that the bearings support the rotor in a centrally fixed position. In the past this requirement has been satisfactorily met by the simple sleeve bearing with its large area and rugged construction. However, the matters of retaining the lubricant and excluding dirt were not so well taken care of by the old type of sleeve bearing, notwithstanding its many years of acceptable service. Oil must be kept away from the motor coils, because oil shortens the life of the insulation, resulting in shorts or grounds, and oil also permits a more rapid accumulation of dust. The best way to keep the motor winding free from oil is to insure that all oil and oil vapor will be retained within the bearing. Equally important is the matter of excluding dirt and dust so as to retain the lubricant in as clean a condition as possible.

The magic element in a sleeve bearing is the film of oil which is maintained between the bearing sleeve and the rapidly rotating shaft. The oil film not only supports the rotating element and affords a surface of least frictional resistance, but it also affords a cushioning and softening medium which protects the bearings and shaft from jars and vibrations. In order for a perfect oil film to build up and function properly, the oil must be kept in a clean condition. Any foreign material, such as minute abrasive or gritty particles, which may be found in any dust-ladened air, penetrates within the ordinary bearing housing, with very detrimental effect to the quality of the oil, and therefore its ability to build up the essential film. Rapid deterioration, resulting in high maintenance and unsatisfactory operation, is the inevitable consequence. Naturally, then, there should be a demand for a bearing having the three essential features outlined, viz., a simple rugged means of support for a centrally located rotating member; an inherent ability to completely retain its lubricant; and an inherent ability to completely exclude foreign material.

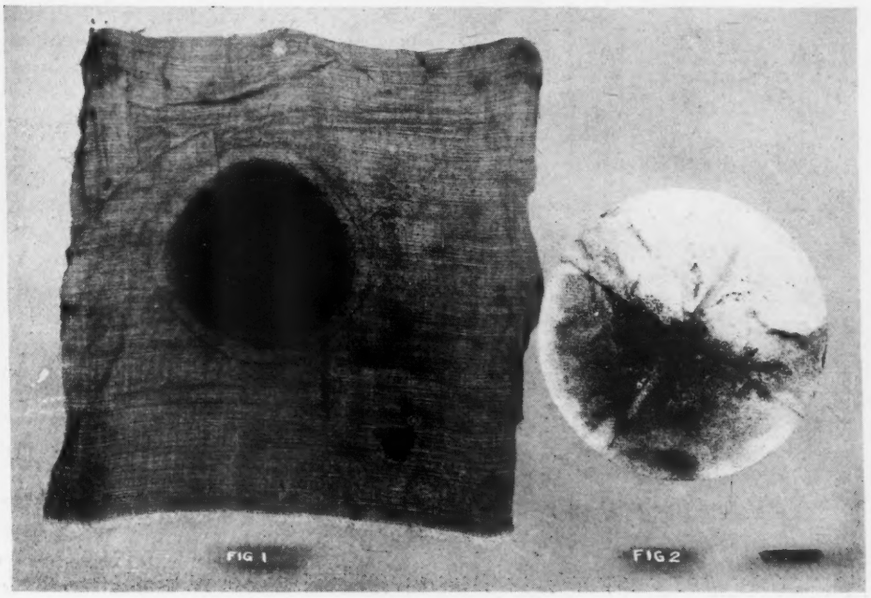


Fig. 4. Showing the amount of sediment found in the front and rear bearings, after the test shown in Fig. 2, indicating almost complete exclusion of dust

Fig. 5. A more severe test under actual service conditions

Sealed-Sleeve Bearings

In an endeavor to incorporate in a practical bearing the three cardinal principles outlined in the proceeding paragraph, and at the same time to retain that magic element of the sleeve bearing—the oil film—the sealed-sleeve bearing has been developed. A casual inspection of the sealed-sleeve bearing pictured in Fig. 1 will indicate that it is really a much improved and refined sleeve bearing, supplying the features listed above. It still offers a large supporting area, and operates on the oil film principle, both of which features have the endorsement of long service. However, additional features are built into the bearing which make it both oil- and dust-tight. Features to note are as follows:

1. Overhanging lip protecting the felt washer prevents distribution of oil spray caused by shaft end-play.
2. Special brass dust-tight filling and overflow plug, provided with a spring closed, cork-gasketed cover.
3. Large settling chamber, removed from ring-agitated oil.

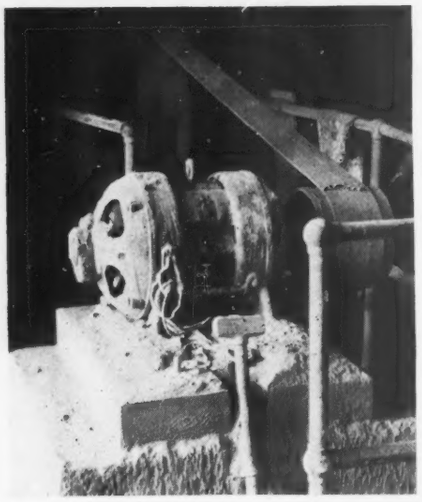


Fig. 6. Showing the dry accumulation of dust on the sealed-sleeve bearings of a motor in a cement plant

4. Air by-pass prevents unequal air pressures and siphoning of oil and oil vapor.

5. Steady pin does not pass through housing, thus eliminating an opening in the housing.

6. Oil ring hole covered by felt-gasketed plate held by screws.

7. Oil-tight inspection hole, covered by ordinary pipe plug.

Tests of Sealed-Sleeve Bearings

The performance of this bearing under the most adverse conditions is backed not alone by theory and drawing-room proof, but by actual operating experience. Figs. 2 and 4 illustrate the conditions and results of a test conducted to demonstrate the oil-tight and dust-tight features of the sealed-sleeve bearing. A standard motor, equipped with sealed-sleeve bearings, and driving a blower as shown in Fig. 3, was placed in a tight box. Six sacks of cement were poured into the box, and the motor was operated for 214 days. Fig. 4 shows the amount of sediment found in the front and rear bearings after this test, indicating almost complete exclusion of dust. The motor windings and housings were bone-dry, testifying to the fact that no oil had escaped from the bearing. Also, marks placed in the bearing before the test were still visible, indicating the absence of wear.

A more severe test under actual service conditions is illustrated in Fig. 5. A motor equipped with sealed-sleeve bearings, driving a slurry pump in a wet-process cement plant, was buried by the slurry for a considerable period, due to a pump failure. After the motor was "dug out" and washed off with a hose, it was immediately put into service, and with satisfactory performance. A subsequent investigation of the bearing oil showed it to be in perfect condition insofar as the entrance of the slurry may have affected it. Such an example, although beyond the ordinary requirements of a motor, speaks eloquently of the quality that is built into the motor insulation and bearings.

Additional service proof is furnished by Fig. 6, illustrating the dry accumulation of dust on the sealed-sleeve bearings of a motor installed in a cement plant. Installations are numerous where the sealed-sleeve bearing has performed under actual service conditions with entire satisfaction. A large number of motors equipped with sealed-sleeve bearings have been installed in cement plants for more than two years. A recent inspection of some of the installations revealed the fact that the operator had only added oil at six month intervals; and that no other attention or maintenance was required. Such performance is indicative of a bearing achievement in which all of the desirable points of a sleeve bearing have been retained and practically all of its disadvantages have been eliminated.

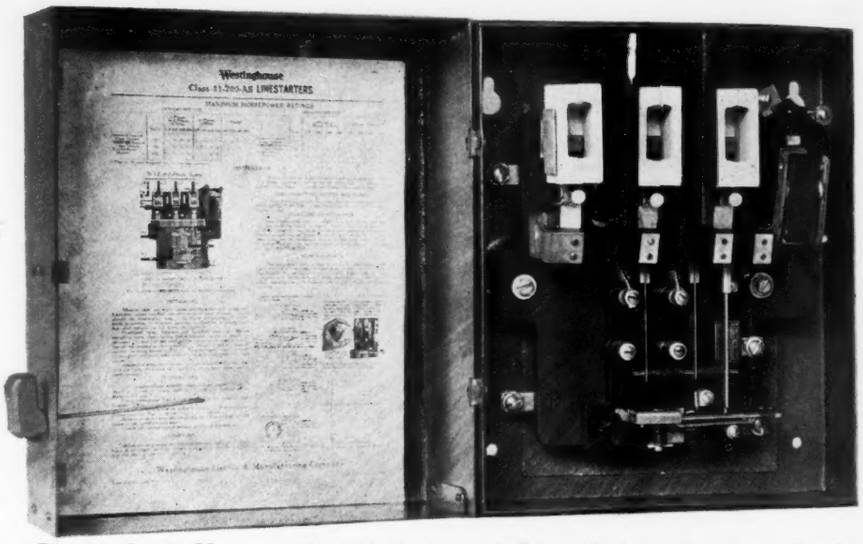


Fig. 7. A suitable magnetic contactor, mounted in a dust-proof, non-ventilated cabinet, together with a thermal overload relay

Selection of Control Equipment

In applying electric motors there are two elements to be considered, the motor itself and the auxiliary equipment. The engineer should avoid giving so much attention to the motor itself that the control equipment is unwisely selected. It should be kept in mind that a motor and control are interdependent members of a combination, and that it is the resultant performance of the combination, rather than the performance of the individual members, that is the criterion of the success of any motor drive. Realizing, therefore, that no chain is stronger than its weakest link, and without implying that the control is the weak member of a motor-control combination, it is well worth while to give careful attention to the selection of control equipment. It is obviously undesirable to limit the capacity of a motor by installing inadequate control, and it is equally undesirable to burden an installation with the added investment require when control of more than ample capacity is installed. Inasmuch as the majority of rock products plant motor applications make use of the standard squirrel-cage induction motor, the comments to follow will be limited to control equipment for this type of motor.

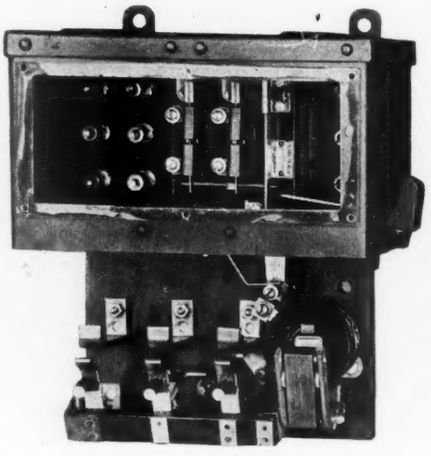


Fig. 8. The starter

The present trend of control practice is towards full voltage starting of all medium size squirrel-cage induction motors where the applications will permit. The fact that many machines in these plants are equipped with friction clutches permits the load to be gradually added after the motor is started and is running at full speed. This method of starting not only offers the maxium pull-out torque of the motor for starting purposes, but it also permits the motor to be started without load, which greatly reduces the duration of the starting surge of current drawn from the line. Obviously, such conditions during the starting period make it possible to take advantage of the superior merits of full-voltage starters.

In addition, the practice of full-voltage starting is approved both by the central stations and the motor manufacturers. The present-day central station system is of suffi-

cient size, and the connected load of the average industrial customer is such a small proportion of it, that the starting current of the ordinary induction motor is only a "drop in the bucket." This situation is further helped by the motor manufacturers themselves, who are placing on the market standard induction motors that will meet the N. E. L. A. recommendations with respect to starting current. The N. E. L. A. recommendation are coming to be accepted as standards and many power companies are writing the N. E. L. A. recommendations into their contracts. The values of starting current locked, for various motors as recommended by the N. E. L. A., are listed in the following table for reference. Current values for a 220-v. system are given. However, current values for 440- or 550-v. may be obtained by multiplying the given values by ½ or ⅖, respectively.

Motor horsepower	Amperes (Locked rotor values) 220-v., 3-phase, 60-cycle
1	26.6
1½	36.6
2	46.6
3	60.0
5	86.6
7½	115.0
10	141.0
15	197.0
20	251.0
25	304.0
30	360.0
35	370.0
40	380.0
50	400.0
60 and above	8.0 amp. per hp.

The fundamental requirements of a motor starter, according to the A.I.E.E. standards, is a controller designed for accelerating a motor to normal speed in one direction of rotation. However, certain other features are usually implied when discussing any starter. Such factors as adequate current-carrying and interrupting capacity, based on the corresponding motor values of current, are always considered as incorporated in any starter. In addition suitable overload and low-voltage protection are almost always included, as well as the qualities of reliability, ease of installation and operation, and low maintenance. The various methods and types of enclosures are of particular importance in any application in a dusty atmosphere, such as is found in the average plant. The consideration of choosing between manual or magnetic control is almost eliminated in the case of medium size squirrel-cage induction motors, due to the superiority of magnetic starters over manual starters from the operator's standpoint; and due to the fact that magnetic starters are competitive in cost with the corresponding manual starters. The result, therefore, of a survey of the factors to be considered when selecting a suitable controller for the average squirrel-cage induction motor, such as is found in a modern rock products plant, indicates that a magnetic full-voltage starter will be entirely satisfactory for the majority of cases. This conclusion has been drawn after a consideration of the actual facts of the case, and it is gratifying to note that it is being verified by actual installation figures. At the present time there are more magnetic full-voltage starters being installed in industrial plants than any other comparable type of starter.

Auxiliary Equipment

In order to meet the conditions as outlined above of a more or less ideal starter,

Fig. 9. The non-ventilated cabinet

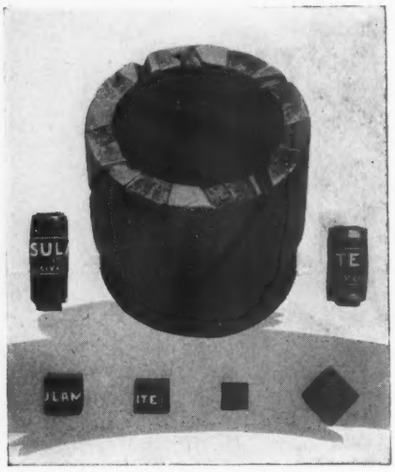
it is only necessary to provide a suitably mounted and protected contactor for the purpose of connecting or disconnecting the motor to or from the line. Suitable auxiliary devices for overload and low-voltage protection shall, of course, be included. A starter incorporating all of the features listed above is illustrated in Fig. 7. It consists of a suitable magnetic contactor, mounted in a dust-proof, non-ventilated cabinet, together with a thermal overload relay. The thermal overload relay has been found to be best suited for a starter of this type, after considerable scientific investigation and experience. A decided advantage of the thermal relay is that its heating characteristic follows closely the heating characteristic of the motor being protected from overload. The desirability of similar characteristics is obvious. In addition, a relay of the thermal type is very desirable for full-voltage starters in that it will not operate on momentary surges, such as exist at the instant of starting, but function only during a sustained overload. It is only natural, therefore, that the trade should demand and that progressive manufacturers should supply overload protection of the thermal type. For applications where better dust protection is desired than is offered by a non-ventilated cabinet, the starter shown in Figs. 8 and 9 is desirable. It consists of a full voltage magnetic starter, including all of the features heretofore mentioned, with the addition that all current carrying contacts are oil immersed, resulting in perfect dust protection.

Although a large percentage of cases may be best served by the magnetic full-voltage starter, there are certain cases where reduced voltage starting is not only desirable but imperative. For instance, a plant with only a few large motors installed would not care to use full voltage starting on the largest motors, because the current drawn from the line during starting would be too large a percentage of the capacity of the installed distribution equipment. The result of overloading the distribution apparatus would be poor voltage regulation, affecting the performance of all electrical equipment connected to the line. An effort should be made to keep voltage fluctuations caused by starting surges within a value such that the overload on the transformers supplying the power will not exceed 100%. It is desirable therefore to install a starter which retains as many of the features listed for the magnetic full voltage starters as possible and still obtain reduced voltage starting. It is a resistance starter completely enclosed and push-button operated. Thermal overload protection and definite time element acceleration are included features. A starter of the resistance type reduces line disturbances, during starting, to a minimum not only by virtue of the reduced voltage that is applied to the motor terminals but also due to the facts that the voltage is automatically increased as the motor comes up to speed, and that the transition from reduced voltage to full voltage is one of small magnitude and is accomplished without opening the circuit.

Other types of control for squirrel-cage, induction motors, including both magnetic and manual, reduced voltage and full voltage types, as well as control for other types of motors found in rock products plants, are being built so as to provide many of the desirable features mentioned in connection with the starters discussed above. Dust-proof and dust-tight features are among the most important qualities to be considered, regardless of the type of control used, when the application demands that the starter function in a dusty atmosphere.

The small additional investment necessary to provide adequate dust protection for the driving motor and control will pay big dividends, in the way of long maintenance-free, continued service. Dust protection is one of the best forms of insurance that can be secured against costly shutdowns and expensive maintenance and it is backed by sound engineering and economic judgment. An appreciation of these facts by the various industries interested in the protection of electrical apparatus from dust is reflected in the general trend towards the installation of equipment with ample dust protective features. The rock products industry is to be complimented on, and encouraged in, this move toward getting ideal service from its electrical equipment, even though operating under adverse conditions.

New Machinery and Equipment



An "N" double tube bit set with 1/4-in. cubes

Substitute for Diamonds in Diamond Core Drills

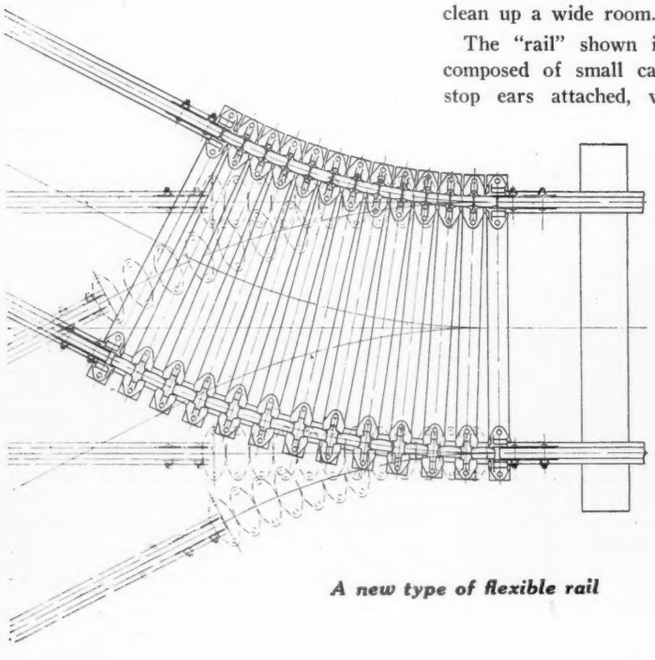
THE Sullivan Machinery Co., of Chicago, has announced a substitute for black diamonds used in setting diamond core drills, which, it is claimed, will prove equally satisfactory under certain conditions. The new substance is known as "Sulamite," a name which is registered as the trade mark for the new material, and the process of its manufacture is a trade secret. The company states that "Sulamite" is a metallic alloy having practically the same characteristics as carbon or black diamond, except that it is not as hard. However, it is claimed that it is considerably harder than emery, corundum and similar substances, and that it has proved its superiority over other substitutes.

The Sullivan company states that the new substance is not for use in igneous, hard sedimentary or metamorphic formations, where unquestionably the true black diamonds are without competition, but in soft limestone, shale and other relatively soft sedimentary strata the substitute has been used satisfactorily. In such cases the lower first cost of the investment for "Sulamite" compared with diamonds offsets the slower progress and higher cost per foot drilled. When these formations are cavey or pockety, as is frequently the case, the possibility of sticking the tools and of injury to or loss of the diamond bit makes the use of the "Sulamite" bit advisable from the standpoint of economy. The cost per unit is very much less than that of black diamonds. The new substitute is furnished in cubes and also in octagonal pieces. These are suited for the different sizes of bits in ordinary use.

Flexible Rail for Shifting Industrial Trackage

THE Illinois Power Shovel Co. of Nashville, Ill., has announced a new flexible rail device for use where it is necessary to shift industrial tracks frequently. The equipment is suited for work outside, such as in sand plants and quarries, and also for work inside of large manufacturing plants. It was originally designed for the latter use, to enable a single track-mounted machine to clean up a wide room.

The "rail" shown in the illustration, is composed of small cast-steel sections with stop ears attached, which rest in chairs mounted on cross ties. Upon moving the track the inside sections contract and the outside lets out, forming a uniform curve.



A new type of flexible rail

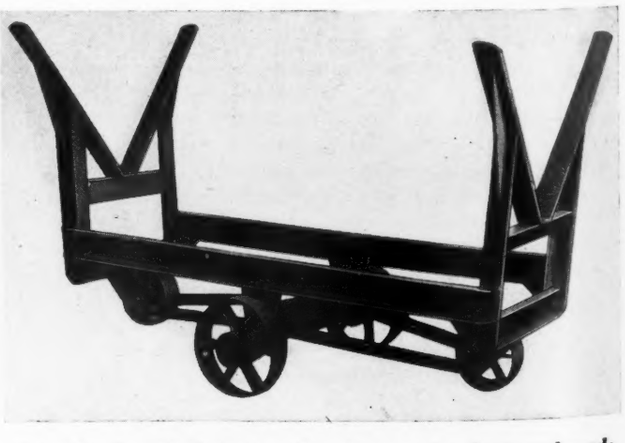
New Shop Truck for Heavy Loads

A NEW type of shop truck, known as the "Weldsteel" truck, has recently been placed on the market by the Pittsburgh Producers Supply Co. of Pittsburgh, Penn. It was originally designed for use in steel mills, but has also been found suitable for use in other industrial plants where heavy loads are to be moved, such as cement mills, crucible works, etc., according to the company's announcement. The truck has a rated capacity of three tons, with a safe overload capacity of 100%, it is claimed. It is compact, the dimensions being 5 ft. long by 3 ft. overall width and 3½ ft. overall height.

Nearly Two Miles of Conveyor Belt, 1¾ In. Thick

DUMPING A SMALL MOUNTAIN, from the heart of the business region in Seattle, Wash., into Puget Sound by means of 10,000 ft. of conveyor belt, is pronounced by engineers as one of the most spectacular engineering feats ever attempted in a large American city. Details of this unusual transfer of earth from land to water, were revealed here through the B. F. Goodrich Rubber Co. The Goodrich company is supplying a total of 63,000 lb. of belt for this gigantic undertaking. The main conveyor belt is 10,000 ft. long and weighs 13½ tons.

Five portable conveyors are to be placed at different positions on the site as feeders to the main conveyor which is 1¾ in. thick and 3 ft. wide. More than 5,000,000 cu. yd. of earth will be moved. It is estimated that



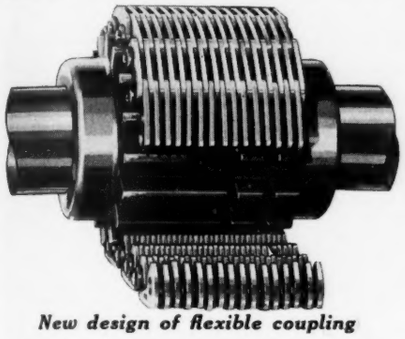
A truck of welded steel sections for use in plants and yards

21 months of 24-hour working days will be required to complete the job. The costs of the project is announced at $2,250,000.

Steel scows will receive the earth at the shore line in Puget Sound and carry it out about 1,500 ft. where it will be dumped. This novel means of shifting a mountain presents a novel feature in the heart of a busy city in that it will not halt traffic or business activity in any way.

New Flexible Coupling

THE Morse Chain Company of Ithaca, N. Y., has announced a new flexible coupling consisting primarily of a Morse chain wrapping two sprockets, each one-half the width of the chain, one of which has a guide groove in the center of its face to



New design of flexible coupling

hold the chain in place, while the other has no guide groove and is free to float under the chain. The chain fits loosely enough on the sprockets to take care of ordinary misalignment and lack of parallelism. High efficiency, durability and simplicity are claimed for this new type of coupling.

New ½-Yd. Convertible Crawler Unit

A NEW ½-yd. convertible crawler crane and shovel, is announced by the Universal Crane Co. and the Thew Shovel Co., both of Lorain, Ohio, which have combined in this new unit their respective units of the Universal superstructure and the Thew center-drive crawler. The resulting unit, designated as the Universal-35, is offered with a complete range of interchangeable attachments including clamshell and dragline booms, shipper shaft and ditcher-type shovels, back digger and skimmer scoop.

The center drive crawler mounting is manufactured under patent rights granted by the Thew Shovel Co. and embodies all the features of this type of crawler, now used as mountings for the "Lorain 75" and "Lorain 60" shovels and cranes. The crawler consists of an all-steel, box-section casting, resting on four large axles, any one of which will support the entire weight of the machine, it is stated. These four axles carry four large rollers on each side, the center two being the drivers, obtaining their power from a common driving pinion gear, constituting the center drive principle.

Jaw clutches, controlled from the operator's seat, and sliding on square action shafts, engage the crawler for steering or travel. In traveling, two speeds are available, 4/10 miles per hour in low gear, climbing a 35% grade and 2.0 m.p.h., or five times as fast in high gear, climbing a 12% grade, the announcement states. With the travel clutches set in neutral, the unit can be towed by an unloaded 3½-ton motor truck.

The center drive principle is also incorporated in the ½-yd. shipper shaft shovel offered on this unit. This unit is claimed to be the first ½-yd. shovel built on this principle. For the crowd mechanism, the Universal-35 uses a direct cable crowd. On the center drive shovel, the shipper shaft is placed in the center section of the shovel boom, at its strongest point. By placing the shipper shaft farther forward in this manner, additional reaches and clearances are obtainable.

The boom is 18 ft. long, of plate girder construction out to the shipper shaft, and of lattice construction from this point out to the boom head. The dipper stick is 14 ft. 4 in. long and is an all-steel, welded rectangular section. The dipper stick rides between two large circular bearings which strengthen the boom and give lateral support. These bearings also furnish a machined track for a six-wheel roller type dipper stick trolley which is used instead of a yoke. The center drive shovel on the Universal-35 is of the most simple design, a shipper shaft, running in bronze bearings, a shipper shaft pinion and a cable winding drum compose the entire crowding mechanism.

This shovel attachment, and the series of other attachments, are all readily adaptable and interchangeable on the superstructure without any changes to machinery back of the center pin. The hoist shaft is equipped with two drums, separately driven, which are grooved for improved cable life, and are

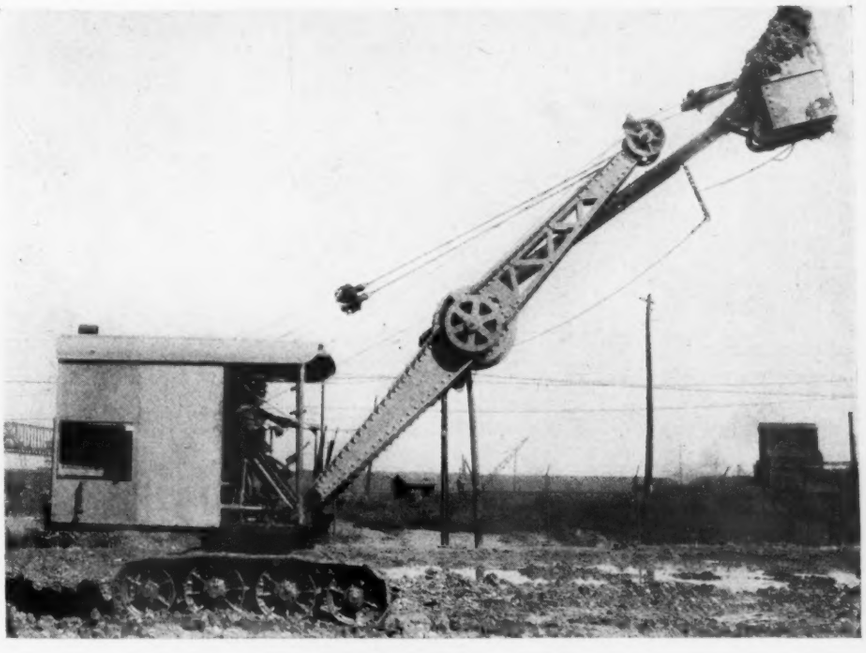
The superstructure is the same as the Universal Crane Co. has built for about ten years for motor truck mounting. All the machinery parts are grouped well back of the center pin, thus acting as its own counterweight and enabling lifting the maximum weight with the minimum dead weight. As a crane, it lifts seven tons at 10-ft. radius, easily handling a ½-yd. clamshell or dragline bucket or a 1-yd. backfiller board.

All controls are conveniently grouped about the operator's seat, which is at the extreme front, providing an unobstructed view. Easier operation is obtained by replacing one hand lever with a second foot pedal so that three hand levers and two foot pedals control all major operations.

As on the company's previous equipment, the new Universal-35 is adaptable to several mountings in addition to the center drive crawler. These include the 5-ton or heavier motor truck mounting, the heavy duty trailer mounting, and several other types. The superstructure is readily transferable to and from any of these mountings, it is claimed. The Universal-35 will be marketed by the Universal Crane Co. from its new general sales offices at Lorain, Ohio, through its national system of branch offices.

McGann Co. to Manufacture and Sell Schaffer Hydrators

THE Schaffer Poidometer Co., of Pittsburgh, Penn., has granted the exclusive sales and manufacturing rights in the United States and Canada of the Schaffer hydrator and hydrator parts to the McGann Manufacturing Co. of York, Penn. The agreement became effective on November 22nd. The hydrator will be sold under the trade name of "McGanco-Schaffer."



New 1/2-yd. convertible crawler unit

News of All the Industry

Incorporations

Evans Gravel Surfacing Co., Ltd., Saskatoon, Canada, $20,000.

Dixie Bauxite Co., Little Rock, Ark., $40,000. P. A. Dulin, 2222 Vance St.

Arkansas Sand and Material Co., Pine Bluff, Ark. Marvin Jones, C. F. Krimm.

Lykstone Cement Products Corp., $10,000, Jamaica, L. I., N. Y., A. Korwan, Jr.

O'Neal Block Co., 1338 N. W. 29th St., Miami, Fla. S. W. O'Neal Cement Products.

Copemish Gravel Corp., Wilmington, Del., $350,000. Colonial Charter Co., Wilmington.

Concrete Products Co., Charleston, S. C., $15,000. T. C. Stevenson, T. C. Stevenson, Jr.

Southern White Limestone and Products Co., Doyle, White County, Tenn., stock reclassified.

Synthetic Stone Corp., Union City, N. J., $125,000. Lillian Baum, May Herzfeld, Marvin Herfeld.

George D. Littell, Inc., Livingston, N. J., 100 shares, no par value. Frank D. Ross, Maplewood, N. J.

Ohio Slag Co., Cleveland, Ohio, 250 shares, no par value. Ralph H. Carroll, John H. Esmond, E. R. Smith.

Acme Sand and Gravel Co., Portland, Ore., $85,000. T. G. Patterson, B. Lee and Allen H. McCurtain, Porter Bldg., Portland.

Intercity Sand and Gravel Co., Vancouver, B. C., Canada, $50,000. Offices of the company are at 402 North-West Building, Vancouver.

Coldwater Crushed Stone, Ltd., Coldwater, Ont., Canada. 1000 shares, preferred stock of par value $100 each, and 200 class "A" and 10,000 class "B" shares of common stock with no par value.

Sand-Man Company, Davenport, Iowa, $10,000. To produce and deal in gravel, sand, stone, and building materials. D. S. Block, president; H. I. Scott, secretary and treasurer. Smith and Swift, Davenport, attorneys.

Quarries

Alex Dewar, Sioux Falls, S. D., has sold his interest in the Dakota Mahogany Granite Co., and will open a new quarry at Milbank, S. D.

Calaveras Rock Co., Carlsbad, Calif., has begun production. The plant is reported to have cost $75,000.

Rockwood-Alabama Stone Co., Russellville, Ala., is reported to be operating 24 hours a day—three shifts. Dimension stone is shipped all over the United States.

Gouverneur Limestone Co., Gouverneur, N. Y., is making improvements, including the construction of a new building which will house the office, air compressor, and blacksmith shop. The walls of the new structure are of smooth-faced cement blocks and in size it is about 20 by 60 ft. The new building, when completed, will take the place of three other small buildings. During the past busy season this concern has extended their quarry westward a considerable distance, and the stone uncovered is of exceptionally fine quality. In that direction the top soil has been removed from an acre or more, and the rock, which is very close to the surface, is all thoroughly sound.

Sand and Gravel

Bridgeton Sand Co., Berlin, N. J., suffered a loss of part of its plant by fire on November 21.

Dolese Bros. Sand and Gravel Co., Oklahoma City, Okla., has let a contract for a $16,000 warehouse at 13 West 13th St.

Estill Springs Sand and Gravel Corp., Estill Springs, Tenn., is increasing its capital from $100,000 to $200,000, and will treble the capacity of its plant.

Decatur Hydraulic Sand and Gravel Co., Decatur, Ill., is now owned jointly by William Bowshier and Roy R. Wilson. Mr. Wilson recently purchased a half interest in the property, including 102 acres of land on the north bank of the Sangamon river.

Wade Sand and Gravel Co., Lilesville, N. C., will develop 135 acres of sand and gravel deposits with a daily output of 20 cars. E. E. Wade is manager.

Peru Gravel and Sand Co., Peru, Ind.; the bins at the plant collapsed on the evening of November 16, causing damage estimated at $2500. Fortunately, the accident happened when the plant had been shut down for the day and no injuries to workmen resulted.

Cement

Beaumont, Tex., imports of cement during October exceeded imports of any other commodity.

Idaho Portland Cement Co., Pocatello, Idaho, expects its plant, now building, to be in production April 1, 1929.

Pacific Coast Cement Co., Seattle, Wash., expects its plant now under construction to be in production during January.

Lawrence Portland Cement Co., Thomaston, Me., it is reported, will operate one of its two kilns during the winter.

South Dakota State Cement Plant, Rapid City, S. D., up to November 16 had made total sales for the season of 493,929 bbl., compared to 366,924 bbl. in the same period of 1928.

Florida Portland Cement Co., Tampa, Fla., is reported to be low bidder for 80,000 sacks of cement for use of the U. S. Government at the Panama Canal Zone.

Petoskey Portland Cement Co., Petoskey, Mich., has awarded a contract to the Burrell Engineering and Construction Co., Chicago, Ill., to build and equip a pack house at Milwaukee, Wis., to cost $80,000.

Marquette Cement Manufacturing Co., Chicago, Ill., is reported to be planning the erection of a stock house at Memphis, Tenn. Besides river connection it will be served by a siding of the Illinois Central R. R. The new warehouse will be constructed by the company at Wolf river and Poplar boulevard. Cement will be shipped into Memphis by river from Cape Girardeau, Mo., and stored in silos. The cement will be sacked at the new warehouse and shipped out to southern points by rail. The city commission recently paved the way for the new warehouse here. Two ordinances were passed, one closing two streets which were platted but not in use, and the other allowing the Illinois Central to construct tracks to the site of the new plant.

Cement Products

Halifax Concrete Products Co., Daytona Beach, Fla. The president of the company, W. S. Snead, has announced that because of the growth of the business, it is necessary for him to relinquish all his connections with the Halifax Builders Supply Co., and to devote all of his time to the development of the products concern.

Pomeroy Cement Block Co., Pomeroy, Ohio, has recently completed a one-story brick building to be used for an office and storage building at its plant. The front part of the structure will contain three offices, while the rear will be fitted for holding trucks, mixers and other equipment, in addition to providing a 24x110-ft. space for the storage of the company's products.

Austin Cement Stone and Tile Co., Albany, Minn., has sold its buildings and land to the Geo. A. Hormel Packing Co., which will use the property for an extension of its facilities. Plans for the future are not announced by the Austin company, but the machinery and equipment is being stored for the winter, and it is probable that the company will resume operations at another location in the spring.

Liston and Son, Mission, Texas. After the first month's operation of the company's new concrete pipe plant, E. B. Branch, the manager, stated that the operation was successful, and that orders received indicated a ready market for the products. The pipe goes largely for irrigation purposes so that the bigger sizes are more in demand. The plant maintains a crew of 12 men, and there are two main pipe machines, as well as supplementary equipment for making building block.

Gypsum

United States Gypsum Co., Charlestown, Mass., received its first cargo of Nova Scotia gypsum by the steamer *Gypsum Prince* on November 14—5500 tons. The plant is not yet in operation.

United States Gypsum Co., Port Clinton, Ohio, suffered a small loss by fire November 9. The fire occurred in the sisal picking room and is thought to have been caused by a spark thrown off by the machinery. Two storage bins were destroyed and considerable damage done by water.

Silica Sand

International Silica Co., Salem, Va., is erecting a plant in connection with the development of bauxite deposits.

Bridgeton Sand Co., Bridgeton, N. J., plans rebuilding power house and glass sand producing plant at Berlin, partly destroyed by fire November 21. Adjoining glass sand plant of Pennsylvania Pulverizing Co. was also damaged and will be rebuilt. Headquarters of latter company are at Lewistown, Penn.

Personals

Gene Pope, president of the Colonial Sand and Gravel Co., New York City, has been elected a director of the Chelsea Exchange Bank.

Charles B. King, vice-president and general manager of the Marion Steam Shovel Co., Marion, Ohio, has been elected president of the Ohio Manufacturers' Association.

Rupert C. Dowd, formerly office manager of the United States Gypsum Co. plant at Fort Dodge, Ia., has been transferred to the headquarters office of the company at Chicago, Ill.

Dwight Morgan, vice-president and general manager of the Virginia Portland Cement Co., Norfolk, Va., has been elected a member of the advertising board of the Norfolk-Portsmouth Chamber of Commerce.

J. R. Thoenen, U. S. Bureau of Mines, Washington, D. C., is spending a short time in studying quarry operations in the middle eastern states and manufacturing processes involved in producing mineral wool from limestone and slag. He will not return to Washington until after the Christmas holidays.

Manufacturers

Jeffrey Mfg. Co., Columbus, Ohio, has appointed Stanley M. Mercier manager of the Boston office of the company, located at 141 Milk St.

Botfield Refractories Co., Philadelphia, Penn., has appointed the Marshall Supply Co., Inc., operating in Pittsburgh, Kansas City, and Tulsa, Okla., as distributor of all their products. Also McCarthy-Jones & Allen Co., Inc., 111 First Ave., S., Nashville, Tenn., as distributors.

Republic Iron & Steel Co., Youngstown, Ohio, has added the following new directors to its board of directors Philip Wick of Youngstown and Myron Wick and Wm. G. Mather of Cleveland.

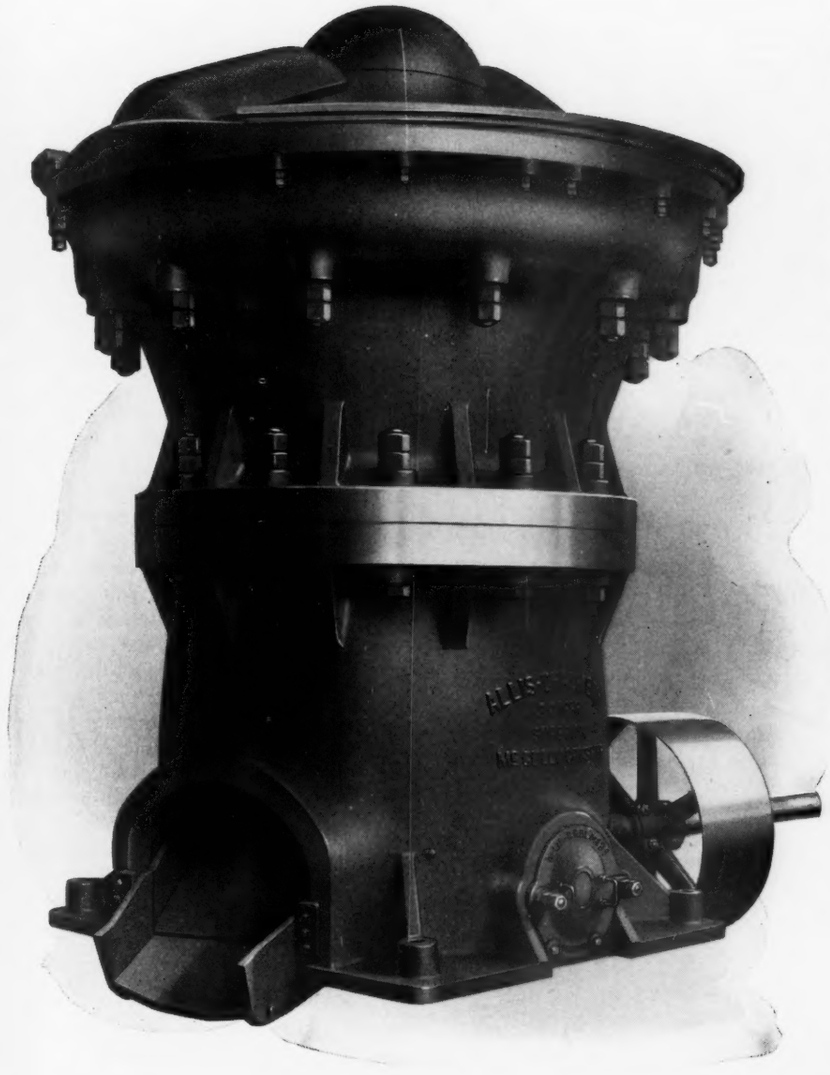
Joseph T. Ryerson & Son, Inc., with plants at Chicago, Milwaukee, St. Louis, Cleveland, Cincinnati, Boston, Buffalo and New York, has taken on the line of portable electric tools of the Millers Falls Co., Millers Falls, Mass.

Prest-O-Lite Co., Inc., New York City, has added a new acetylene plant to its chain, bringing the total number of acetylene producing plants throughout the country up to 35. The new plant, located at East Ave. and Short St., South Charleston, W. Va., started production on October 29, to supply the local demand for dissolved acetylene for welding and cutting. J. J. Robinson is in charge of the plant and S. P. Murphy, whose headquarters are at Cincinnati, is district superintendent.

Johns-Manville Corp., New York City, has acquired the properties and assets of the Celite Co. of Calif. The Celite Co. brings an annual business of approximately $4,000,000 in sales of insulating products, made from diatomaceous earth, and its deposit of this earth in California is said to be one of the largest known sources of its kind. It insures Johns-Manville a supply of this basic material for

Superior-McCully Crushers

Points of Superiority



Rigid spider hub, due to close coupling of shaft bearings, maintains perfect alignment of bearings and reduces strain on spider.

Eccentric is placed directly below the head. This greatly increases the strength of the shaft; eliminates shaft deflection and consequent breakage and results in greatly increased crushing capacity.

Improved type of dust collar excludes all dirt from the eccentric bearing.

Gear and pinion are of cast steel with cut teeth flooded with oil, insuring smooth operation and long life.

Main frame bored at the factory for all three hands of drive.

Lubrication of eccentric bearings and gears is effected by means of a geared oil pump located in the oil chamber in the bottom plate. This positive pump results in a continuous flow of oil from the pump to the top of the eccentric, and the flooding of the gears with oil.

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

at least 50 years. In the past Johns-Manville has been dependent upon the Celite Co. for its supply of diatomaceous earth.

Continental Motors Corporation's industrial division achieved distinction recently when the Associated General Contractors of America conferred upon their Red Seal heavy duty industrial engine series the "Seal of Successful Performance."

Chain Belt Co., Milwaukee, Wis., announces the appointment of W. B. Marshall, who has been associated with the company since 1921, as sales manager of the contract engineering department. Mr. Marshall was graduated from the Sheffield Scientific School of Yale University in that year, and after several years' work in the shops and foundries of the company was made secretary to the general manager and later spent some time in the Chicago office. In 1926 he returned to Milwaukee and engaged in contract engineering sales work until his recent appointment.

J. P. Devine Mfg. Co., Inc., New York City, at a special meeting of the board held on November 11 at Buffalo, elected Charles P. Devine president of the company to fill the vacancy caused by the recent death of his father, the late J. P. Devine, who founded the organization. R. K. Weber, who succeeded the late W. C. Arthurs as chairman of the board, announced also the election of H. H. Cust, vice-president; C. W. Reynolds, secretary; and D. P. Settlemore, treasurer. David O. Arthurs and P. J. Cooney were elected to the board of directors, and Mr. Cooney was appointed assistant to the president.

Timken Roller Bearing Co.'s expansion program to provide the necessary equipment for raising the company's present output of 175,000 bearings per day to over 200,000 per day, has necessitated the expenditure of about $6,000,000 during the current year, and covers additions to both the steel mill and bearing factory. Added steel producing facilities, now in operation, have increased the capacity of the plant to 30,000 tons per month of open hearth and electric alloy steels. These include additions to the mill at Canton, Ohio, and the purchase of the plant and equipment of the Weldless Tube Co. at Wooster, Ohio. Work has also been started on various extensions to the bearing factory for the machine equipment needed to take care of the increase in the production schedule.

Wagner Electric Corp., St. Louis, Mo., announces that F. T. Coup, formerly in charge of their Cincinnati office, has been moved to Milwaukee as branch manager of the company's office there. Mr. Coup joined the Wagner organization upon graduating from the University of Wisconsin in 1912, and since then has been engaged in various sales capacities with the company. Paul F. Forsyth has been appointed to fill the vacancy at the Cincinnati office. Mr. Forsyth was graduated from Penn State College in 1912 as electrical engineer, and previous to his connection with the Wagner organization was doing hydro-electric development work. He joined the company in 1915 and engaged in sales work up until the time of his appointment as branch manager of the Cincinnati office.

Foote Bros. Gear and Machine Co., Chicago, has acquired an interest in the following four companies, specializing in the manufacture of highway and road building equipment: Lyle Culvert and Road Equipment Co., Stockland Road Machinery Co., Northwestern Steel and Iron Corp., all of Minneapolis, Minn., and the Bates Manufacturing Co. of Joliet, Ill. This acquisition necessitated an increase in the capitalization of the Foote company to 250,000 shares of common stock. Besides providing funds for the acquisition of the interests in the four companies mentioned, the increase in capitalization gives the company $1,250,000 new cash capital which will be used for additional expansion. The companies in which interests has been acquired are quantity users of gear products, which will naturally increase the gear and reducer production of the parent company, while the heavy requirements of the various companies for steel and iron castings will automatically feed the Diamondon grey iron foundry and the Northwestern Steel and Iron Division of the company.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Dump Trucks. Illustrated catalog showing three-way dump trucks and truck bodies. THE COMMERCIAL SHEARING AND STAMPING CO., Youngstown, Ohio.

Clam Shell Cranes. Catalog pictures the present models of clam shell cranes and drag lines for a multitude of uses with construction details. THE DAYTON-WHIRLEY CO., Dayton, Ohio.

Concrete Mixer. Illustrated pamphlet describing the exclusive features of their concrete mixer that is manufactured in a variety of sizes. CONSOLIDATED CONCRETE MACHINERY CORP., Adrian, Mich.

Standard One and Two Story Steel Buildings. 37-page pamphlet outlining the types of buildings supplied, photographs of installation now in use and outline of essentials for buildings of this type. BLAW-KNOX CO., Pittsburgh, Penn.

Heating Units for Floors. Details of construction, sketches, descriptions of installations and engineering data pertaining to high and low pressure type floor and ceiling heaters. **Bulletin No. 7418.** AMERICAN BLOWER CORP., Detroit, Mich.

Idaho Talc Property To Be Developed

THE GARNER RANGE Co. of Lewiston, Idaho, has been incorporated to develop a large talc (silicate of magnesia) deposit in the Salmon river country of central Idaho. The new company, incorporated for 1,000,000 shares of a par value of $1 each, will have offices at Kellogg, Idaho, and Spokane, Wash. It is claimed that the new industry bids fair to become one of some importance and is being rapidly developed to a stage of large production.

The mine is located about one mile above Pollock on the west side of the Little Salmon. Officials of the company claim that there is an unlimited amount of talc of the very best quality. The price of the mineral varies with the quality. The uses of talc are general and include almost everything from talcum powder to an element for electric ranges. Most of the talc used in the West, is a Japanese product and the values range from $16 to $750 to the ton.

W. C. Garner, the incorporator of the company, is favorably known in the Coeur d'Alenes. He was in the district for several months about a year ago, in the interests of his company.—*Wallace* (Idaho) *Press-Times.*

Magnesia Plant To Be Built at Lockland, Ohio

THE largest high-pressure steam plant in the world will be constructed at the Lockland, Ohio, works of the Philip Carey Manufacturing Co. of Cincinnati, according to announcement made recently in New York City. The plant will be used in the making of asbestos, asphalt and magnesia products.

Two huge steam generators will be supplied by the Combustion Engineering Corp. of New York.

Gravel Used in Airport Construction

A NEW COAT OF GRAVEL will be scattered over sections of the runways at the municipal airport at Oklahoma City, Okla., it was announced recently, following difficulty of flyers in the rainy weather.

The east-west runway, poor enough at its best, was used very little during the rainy weather, and the north-south strip was rough and soggy in places.

The new gravel will be spread as soon as the runways dry out sufficiently to allow correct cohesion with the base, Henry C. Martin, Chamber of Commerce aviation committee chairman, said. Arrangements for more gravel had been made several weeks ago, but the committee was awaiting a rain before applying it.

The aviation field management has received many complaints owing to the excessive amount of dust that is now on the field. The rains of the past season helped lay this dust somewhat.

Dust had been a menace prior to the rain.

A huge white wooden "T" to guide landing and taking-off airplanes is being constructed, Clint T. Johnson, field supervisor, said.—*Oklahoma City* (Okla.) *Times.*

Finds Gravel Pit as Profitable as His Sheep Ranch

WHILE he has been successful in the sheep business, a sand and gravel deposit on his ranch near Cascade, Mont., has proved to be possibly more profitable than his flock during the best years, Charley Tintinger, prominent sheepman, admitted when he visited the headquarters of the Montana Woolgrowers Association recently.

Some years ago Mr. Tintinger started excavating along the bank of the Missouri river and discovered the deposit. It proved to be the material best adapted to paving and concrete work, and ever since he has been selling the product in large quantities for power dams and other building operations where the material is needed.

The deposit is about 30 to 40 ft. in thickness and lies on a strata of clay. Much of it is under water. A topping of earth perhaps 8 ft. thick is removed before the sand and gravel is reached. Mr. Tintinger rigged up a conveyor, used a big tractor as a "dead man," and operated a steam shovel. The gravel is scooped up, sent into the conveyor to a screen which separates the gravel from the sand, and is deposited by other conveyors to railroad cars usually arranged in pairs—one for the sand, the other for gravel. The new dam, work on which is soon to begin near Great Falls, will require from 25 to 30 cars of material from the Tintinger ranch per day. Gravel and sand are also furnished in quantities for paving in various cities.—*Helena* (Mont.) *Independent.*

Florida Fuller's Earth Plant Enlarged

THE Fullers Earth Co., Midway, Fla., has let contracts for a new unit, to give an increase in capacity of 25%. The company has enjoyed a steady growth over a period of time, and since January has operated at full capacity night and day to keep abreast with orders.

The plant and mines are operated entirely by electricity furnished by the West Florida Power Co., and employs a normal force of 180 men.—*Tallahassee* (Fla.) *Weekly.*

ROTEX

The popular No. 6-R ROTEX shown below has a screen surface 3 ft. by 7 ft. and quantity production makes possible the very low price of $620.00. This model includes all of the features of the larger "Heavy Duty" series, including the double balance wheel system for preventing the transmission of vibration to the foundation of the machine.

No. 6-R Screen

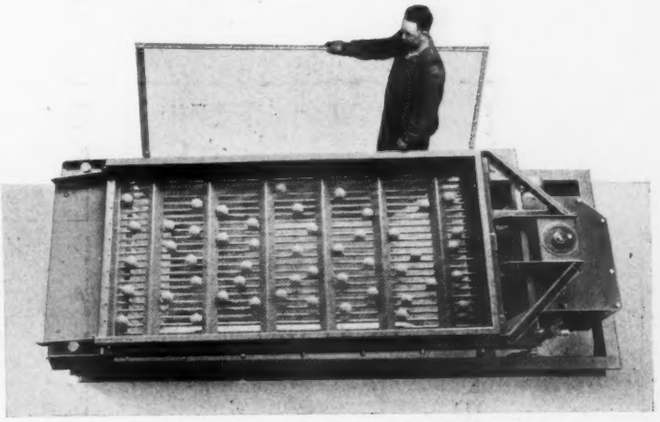
RAPID screening is accomplished largely by the patented method employed for keeping the meshes open. In the picture below can be seen the solid rubber balls confined in pockets under the screen cloth, which are deflected upward so as to dislodge material between the meshes by ***direct pounding contact.***

ACCURATE separations result from the nearly level position of the cloth surface. A crank motion at the head end of the screen frame moves the screen in a large level circular path which slides the material rapidly over the surface.

UNINTERRUPTED screening is secured through the use of heavy construction, the best of materials, a design that is water proof, dust proof, and correctly lubricated, so that the continuous service one expects becomes a fact.

SPECIFICATIONS OF ROTEX SCREENS

Model No.	Arrangement of screen surfaces	Size of each screen surface, ft.	Max. hp. required	Approx. net wt., lb.	Net price for pulley-driven screen, crated f.o.b. cars Cincinnati
6-R	Single deck	3x7	3	1750	$ 620.00
14	Single deck	4x8	5	3900	1,150.00
18	Double deck	4x6	5	3900	1,320.00
22	Triple deck	3x5	5	4100	1,480.00



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Volume XXXI Chicago, December 22, 1928 No. 26

Happy New Year!

A couple of years ago a popular slogan was "1927 will reward fighters." Maybe it did; but 1928 did not; 1929 will reward the intelligent and the cooperator, rather than the fighter. May we have peace and prosperity.

—The Editor

The Year 1928 in the Rock Products Industry and the Prospects for 1929

Valedictory 1928

The volume of construction in 1928 probably exceeded $8,000,000,000—probably exceeded the volume of construction in 1927 by 3%. Significant increases in construction were streets and roads, industrial and commercial building and federal government projects—all kinds of construction using large quantities of rock products. The volume of business generally, in 1928, bids fair to exceed all previous records. Savings banks' deposits in the United States for the year ending June 30 showed the greatest gain for any single year ever recorded. There was the stupendous total of $28,400,000,000 in savings deposits—or about enough to have liquidated the world war debt of the United States. Generally, speaking then, there was widespread prosperity in 1928.

Certainly those industries producing building material should have enjoyed a fair degree of prosperity. In a country so large as the United States, with so many diverse local conditions, obviously one can not describe conditions accurately in distinctly local industries in general terms. But as in several other, if not most basic commodity industries, profits were not generally considered adequate, nor conditions favorable to the rock products industry. While production and shipments of cement will show slight increases over figures for 1927, and the production of sand, stone and gravel undoubtedly will prove to be approximately the same, or a little more, than in 1927, prices in a great many industries show declines, so that the total dollars and cents value of rock products produced in 1928 will probably show an appreciable decline compared with the figures of 1927. Wages have continued at approximately the same level, so that the differences in total value of products made in 1928 and 1927 represent a loss of profits, except for such savings as were possible in costs of production through better management or more efficient plants.

Since many machinery and equipment manufacturers supplying the rock product industry report a very satisfactory year—in numerous cases, the best ever—it is apparent that producers are making strenuous efforts to increase the mechanical efficiency of their plants. All too often, unfortunately, this involves an increase in productive capacity which it is not possible to utilize without cutting into some other producers' preserves. The result has been rather fierce competitive conditions in all of the rock products' industries, with few exceptions. Of course these conditions are common to many other industries and are the apparently inevitable result of a period of prosperity which gives producers the financial resources to improve their operations. The general trend of all industry is illustrated by the fact that the percentage of corporations reporting deficits has steadily increased from 41% in 1925 to probably nearly 50% in 1928.

This very large percentage is accounted for by the fact that included in the corporations reporting deficits are found very many of the smaller concerns. Other figures have been compiled to show that a very small percentage of all corporations make nearly all the profit. It is said 459,244 corporations divide 64% of all corporation incomes, but only 214 corporations take 36% of all the profit. There are a few prosperous concerns in nearly every industry. So failure to make a profit is not necessarily the fault of an entire industry. It is frequently the fault of individual management, coupled with unfortunate circumstances in some cases.

Prospect 1929

Highway bond issues totalling $240,000,000 were voted in Iowa, Missouri, West Virginia and Louisiana at the November elections. Proposed bond issues totalling $110,000,000 were defeated in Pennsylvania and Colorado. Evidently the volume of street and roadbuilding in 1929 will show no recession from 1928, but there will be shifts to new localities. Traffic accidents in cities and on the public highways continue to show a steady increase, and inevitably more and more attention will be paid to grade separation at crossings, to wider streets and roadways and life-saving structures. The annual number of deaths from automobile accidents increased from 6,983 for the year ending November 3, 1927, to 7,226 for the same period in 1928. The Interstate Commerce Commission has agreed to defer further orders to the railways requiring the installation of train control devices, at the request of the railways, to give the railways the financial means to meet a constantly growing public demand for highway grade crossing removal.

Casualities at railway-highway grade crossings are getting to be far more of an economic factor than casualties from railway train accidents. Fatal accidents at grade crossings increased from 1,791 in 1920 to 2,371 in 1927; non-fatal, from 5,077 to 6,613. At $30,000 each for lives lost, which statisticians claim is a conservative estimate of the value of an American life, $71,000,000 is being lost annually in railway grade crossing accidents alone, merely from deaths, and probably as much more in non-fatal injuries. Railway capital expenditures, on the other hand, have been steadily declining for the past four years—for roadway and structures they were 8.5% less in 1928 than in 1927. The time has come to change these conditions.

New markets for rock products construction mate-

rials are constantly developing; for example in the construction of air ports. Grass or turf is giving way to concrete pavements, or graveled or macadam surfaces, or to asphalt pavements. Water power now furnishes one-third the total electrical energy available in the United States. In eight years the total hydro-electric horsepower has increased from 7,000,000 to 12,000,000. Applications for federal licenses to develop water power now pending involve 15,000,000 hp.—about 3,000,000 more than is now developed. Hydro-electric power plants including the erection of great dams and incidental structures make huge markets for cement and aggregates. President-Elect Herbert Hoover has said that every drop of water that finds its way to the sea without having yielded all the electrical energy it is capable of is an economic waste. Moreover, Mr. Hoover has announced a definite policy of inaugurating public works to maintain a normal volume of construction from year to year.

Hence, there is every reason to believe the present large consumption of all rock products construction materials will continue indefinitely and will grow continuously for many years to come. But there will be constant shifting of markets, as best illustrated in the table of portland cement consumption by states, published elsewhere in this issue. The problem of the individual local producer is therefore to so adjust his operations that there may be a profit in the lean years, as well as in the fat years. The answer to this problem, we believe, is in more intelligent management through the use of market statistics that can readily be made available, as we have outlined in the following pages.

Less Blind Competition

Our modern development requires that we be able to translate into numerical expression, what was formerly only vague sentiment. We must learn to do business in daylight instead of in darkness. There should be no elimination of honest competition, but there must be an elimination of blind competition. Mass methods to increase consumption in some industries have probably reached a temporary limit. For the next few years the same intensive efforts to increase business must be applied by each producer to his own sales territories. Mass methods to increase consumption make it easy for newcomers to enter the industry and "cash in" on such promotional efforts. Individual cultivation of one's own territory make it difficult for outsiders to break in.

Present competitive conditions are often the result of an attempt at expression of individuality. Virile business men do not like to be members of a common herd. They refuse to be dictated to by their more powerful competitors. This individuality and personal independence must be preserved, for it is the keystone of our national life. But its expression must find an outlet through greater intelligence, as it may if the producer is able to know his market and its limitations thoroughly and wills to make a profit in spite of what are now unfavorable conditions.

It is surprising how few producers know the actual costs of their product—not merely the cost of manufacturing the product and putting it in the bins, but the cost to get it into the hands of the consumer, or what might be called the ultimate commercial cost. Few realize that the potential capacity, or surplus, controls the price of a commodity and brings a lack of prosperity to the producer and no ultimate good to the consumer. An intelligent analysis and discussion of supply and demand, not as a whole, but in market districts, could not but help make the intelligent producer regulate cost and price so that the result might stabilize reasonable profits. On the following pages we have attempted to make this more clear by a specific example.

The problem is to protect the smaller producer without resort to mergers. Only by such protection to the smaller concerns can real equality of opportunity be fully assured. So it is the smaller producer who must strive to master scientific management and merchandizing, as his larger competitors are rapidly learning to do. This is possible, even in a small concrete aggregate business, as we have detailed in a series of articles in ROCK PRODUCTS during the year. By intelligent scientific merchandising one small company was able to net an average sales price 14c per ton above the average price for which competitors sold their products—8% more.

The law of the survival of the fittest still holds, and always will. But our definition of "the fittest" is constantly being revised. In the jungle it means the strongest physically and the least scrupulous; in modern, civilized, business life it means the most intelligent, the most efficient, the best prepared. There is more opportunity for an expression of individuality, for personal triumph or satisfaction, if these be the goals, in playing the business game with all the facts in hand—in daylight—as in playing it in darkness and in vengeance. As secretary of commerce, Herbert Hoover has said: "Industry and commerce are not based on taking advantage of other persons. Their foundations lie in the division of labor and the exchange of products. . . . By some false anology to the 'survival of the fittest' many have conceived the whole business world to be a sort of 'dog eat dog'. We often lay too much emphasis upon its competitive features, too little upon the fact that it is in essence a great cooperative effort."

The Anti-Trust Laws

Whether or not the anti-trust laws of this country need revision is a much debated subject, and will remain one, probably, for a long time to come. Through our editorial questionnaires we have obtained in confidence the opinions of hundreds of ROCK PRODUCTS readers on the prospects of changing these laws and on legalized price-fixing as a business policy. We shall not attempt here to analyze or digest these opinions. The subject will be a live one during all of President

Hoover's administration, in all probability. And from time to time we shall discuss it in the light of opinions from many interested readers as our guide. Our own present opinion is that any legislation is in error that destroys initiative or tries to control fundamental laws of economics which control business. Any law in peace time that controls prices for any industry is class legislation and unsound. On the other hand, under the able direction of Mr. Hoover, the United States Department of Commerce has successfully brought about a reduction of wastes in many directions in many industries. In many instances results have been accomplished which a few years ago we would have said were as impossible of accomplishment, as are the problems of the present situation. Should we therefore sit back and say no improvement can be expected in the present waste of capital?

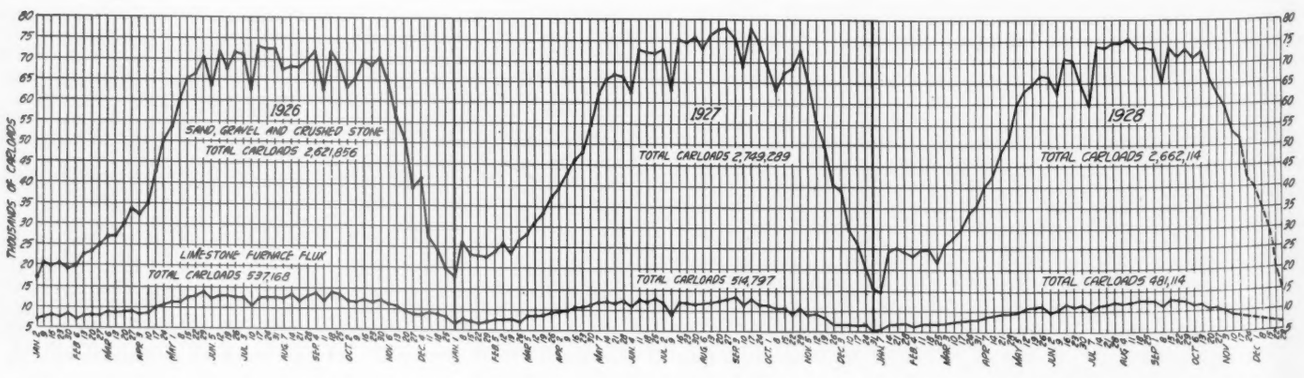
The answer, of course, is emphatically no. We believe the incoming administration will offer every legitimate help to all business. But Mr. Hoover has repeatedly said: "I have no patience with those who deliberately try to confuse these efforts at cooperation with price-fixing and restraint of trade." Several years ago, he said he was whole-heartedly engaged in lifting the movement for self-expression in business above the grounds of prevalent suspicion. "Any intelligent person who has the patience to read and think these problems through, and the methods we have developed for their cooperation, will find these efforts to be in the interest of public welfare, and free from trade restraint. They are in fact the foundations of real competition," President-Elect Hoover has declared. He has also repeatedly said that the test of business is not its size but its integrity and usefulness of purpose, and that the foundation of business is the independent business man. Mr. Hoover has also said that "big business" is quite competent to look after itself, but it is the small independent business man who should be encouraged to cooperate for his own survival under present conditions, which make it especially hard on him if he does not cooperate. That is why Mr. Hoover has done so much to encourage trade and industrial associations.

Business Must Regulate Itself

It is of ominous significance that every instance in which, for special consideration, the government in this or any other country has granted special privileges and exemptions under anti-trust laws to particular fields of business activity, such as railroad, transportation, shipping, banking, agriculture and labor, it has found itself compelled to set up special bureaucratic agencies of supervision and control — such as the Interstate Commerce Commission, the Shipping Board, the Federal Trade Commission, the Federal Reserve Board, etc., whose functions are to supervise and control the exercise of these privileges in the public interest. It is impossible to escape this result if we enter into an agreement with the government for the price-fixing of a commodity, or other special privilege.

The government, through the Federal Trade Commission, is already attempting to help industrial and business associations enforce codes of ethics. But the members of the commission are already divided among themselves as to the legality of some of the steps it has taken in this direction, to say nothing of the question of the desirability of these steps as a government policy. Moreover, the courts will probably nullify much that has been done in this direction.

The public is entitled to the benefits derived from honest competition; but competitors are entitled to fair competition. The legitimate interests of business are in harmony with the true interests of the public. But the most difficult problems of business and industry are not mass problems, but problems of individual management, for which there is no substitute other than intelligence and scientific management based on facts. All the laws, or lack of laws, in the world will not make crooked business men straight nor ignorant management intelligent. But each individual business man may set himself to the task of managing his own business in a straightforward, enlightened way, and in seeing to it that the crooked and ignorant business man is eliminated so far as it lies in his power to eliminate. And in the last analysis *he* is the public.



Car loadings of sand, gravel and stone (above) compared for three consecutive years; with last six weeks of 1928 figures interpolated. Below, the same data on limestone flux for the steel industry

Market Analysis and Budgeting Production and Sales

New Ways Must Be Used to Maintain Profits—Co-operative Statistical Bureaus

By Nathan C. Rockwood

PRODUCERS AND MANUFACTURERS' co-operative associations that have been successful have been mainly concerned with promotional efforts to create new and larger markets. These efforts in many instances, like those of the Portland Cement Association, have been remarkably successful. Such promotional efforts by one industry after another have given rise to "the new competition" where one organized industry competes with another for expansion of its market. As long as all markets continue to expand, or as long as one of these industries is more alert than its competitive industries, all goes well in that particular industry. But as competitive industries learn, the markets of all become more circumspect.

Moreover, mass efforts, or cooperative efforts, to promote consumption of a commodity also inevitably result in promoting new and larger production, so that a "vicious circle" is created in which established producers pool effort and money to enlarge markets only to have production encouraged on a still larger scale, both by their own organizations and by newcomers. Literature and propaganda designed to sell the commodity are often used by promoters to sell securities in new plants. To a certain extent new production aids as a spur to still greater promotional efforts; it is "the leaven in the dough"; but there is a limit to all things, and there is a point beyond which mass markets can not be expanded as fast as mass production. Practically all the rock products industries have reached that point, and producers and prospective producers should face the issue squarely.

We do not infer that such national promotional efforts are in vain, or that they should cease; on the contrary they should be redoubled. But, in a general way, we have reached a limit to what they can accomplish in expanding markets. All their energies for a while at least will be needed to hold what they have gained, as more and more industries adopt similar promotional work. What is needed most is the same intensive effort on the part of individual producers, and small groups of producers, in particular market territories, to take up the promotional work where the national associations leave off.

Scientific Management and Intelligent Use of Statistics

The time has come to apply the same science and skill that has long gone into production, to sales and distribution. The problem is capable of scientific analysis and the use of judgment based on mathematics and on determinable statistical data and facts.

The first step is to determine the extent of the market—*the future market.* The future market of most rock products depends on construction. The value of each material that enters into construction bears a definite relation to the value or volume in dollars and cents of all construction. This relation of course is variable for each commodity, with the kind of construction, and to some extent with the geographical location. These factors must be analyzed and studied for each market territory.

To illustrate we have determined the relation of cement, lime, gypsum, crushed stone and gravel, etc., so far as past statistics are available, to the total volume of construction for the past few years. These figures (and the plotted figures in the form of the accompanying graphs) show that for the United States as a whole, of the total amount of money spent for all construction work between 3½ and 5½% went for the purchase of portland cement. Moreover, the percentage spent for cement has steadily decreased from 1920 to 1927. This, probably, means that the price of cement has declined (or remained stationary while other prices went up) relatively to the prices of labor and other commodities which go into construction. At present it seems stabilized at about 3½%. In the same way the percentage in dollars and cents value of every commodity entering into construction may be determined and studied.

The first question a producer must ask himself then is: Is my industry holding its own for its share of the construction dollar? Of every dollar spent for construction at the present time the portland cement industry gets 3½c. Is this a fair share? As its price relative to other commodities declined, were we not entitled to a much larger volume of output? Can it be made larger? How? The same method of analysis applies to all other rock products.

Cooperative Statistical Bureaus

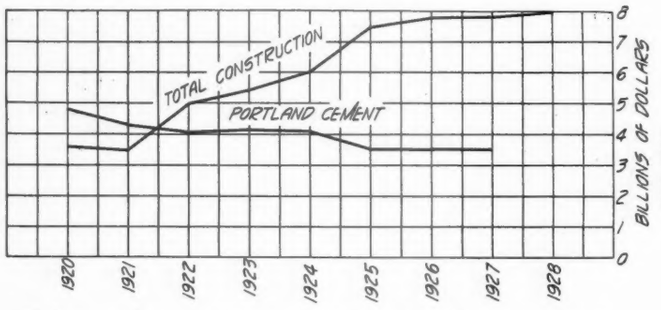
The figures we have given are for the purpose of illustration only and are of general interest only. But the same system of analysis can be applied to each particular market territory. Moreover, what is wanted is not a post-mortem examination of business passed and gone, but statistics upon which to base quotas of production and sales for the next year.

Fortunately, in the case of the construction industry this is not difficult. In the case of public works bonds must be voted and sold months in advance of

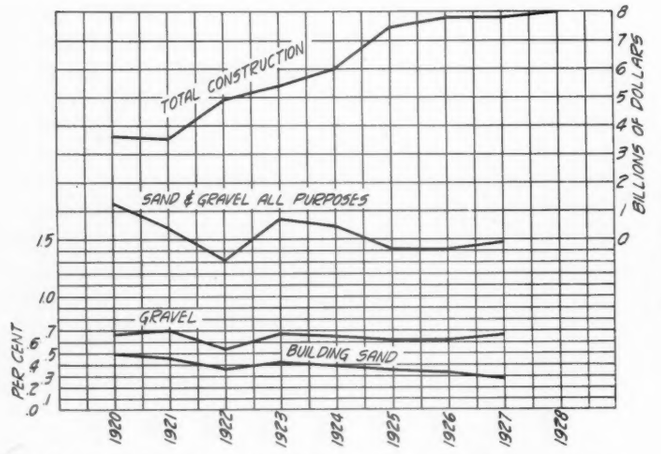
actual construction. Contracts are let, generally, months in advance of material deliveries; some one has found out that the average interval between contract lettings and cement deliveries is about six months. Building permits must be obtained in advance of all urban construction. Nearly all important city building is planned months in advance of contract lettings. Engineers and architects offices could keep a statistical organization informed many months in advance of contemplated construction.

Each market territory, each worthwhile community then, should have an efficient and competent statistical bureau to compile statistics of construction *to be done*. Then each industry furnishing building material can determine from the past records of that community, from the statistics for the United States as a whole, from its prospects to expand its consumption in that particular market, just what percentage of that dollars-and-cents volume of new construction it may expect to corner for its own product.

Who is to found and maintain these construction statistical bureaus? The government? Probably not —in our life time. Any one construction material industry? Possibly, but few are big enough to do the job right alone. Why should not all the construction material manufacturers in a market territory cooperate to found and maintain such a statistical bureau? All are interested in proportion to their fair share of the market. Is there any good reason why they should not cooperate?



Volume value of construction plotted against percentage of that volume value spent for portland cement



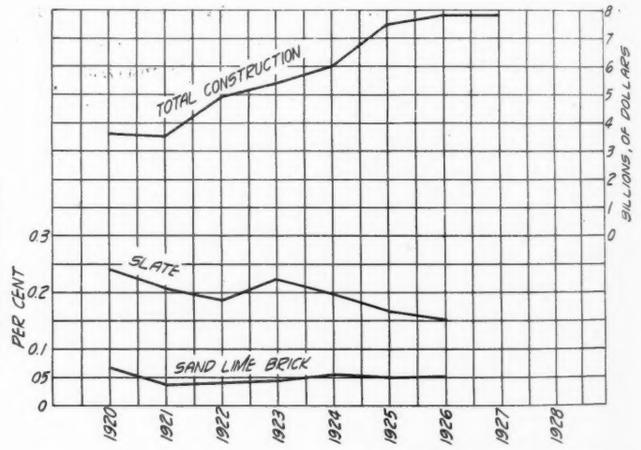
Volume value of construction plotted against percentages of that volume spent for sand and gravel

Market Analysis

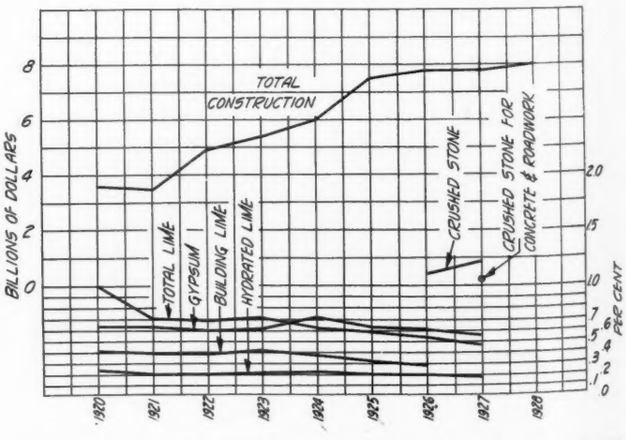
Having determined the size of next year's market in advance, which is perfectly feasible, each producer and manufacturer can study it in respect to his own industry, his own plant and his own business. For an example we have taken a cement plant, which we will call *A*. A rough map, or chart, of the market territory is shown on page 103. We will say the plant has a local trucking market about the mill in which $1,000,000 worth of construction will be done. In this territory the plant can largely make its own price, within reason. Other markets, and the freight rates to reach them, are shown in the chart, or diagram.

The sales manager, or manager, or president, determines the probable price in each market based on the present price, probable competition, etc., etc. He may set up several prices and make an analysis based on each price. He has competing plants at points *B* and *C*, as well as others not shown.

Let us assume that the total volume of construction in the sales territory reached by these three competing plants will be $241,000,000, as determined by the various construction materials statistical bureaus. Using the average statistics for 1927 construction for the United States as a whole (which of course would



Volume value of construction compared with percentages spent for slate and sand-lime brick



Volume value of construction compared with percentages spent for gypsum and lime

be modified to suit these particular local conditions) we take 3½% of $241,000,000 and find $8,435,000 will be spent in this territory, in 1929, for portland cement —that is the net mill value.

Assuming that the net mill price in 1927, which was $1.62, was satisfactory (of course a better figure might be contemplated), there will be a demand in this territory for 5,200,000 bbl. Here, of course, the manufacturer would weigh the prospect of decreasing his market by increasing his price, or vice-versa. Assuming that the $1.62 price is fair, and that the market will absorb 5,200,000 bbl., the manufacturer knows that the capacity of the three competing plants is 6,000,000 bbl. And, we will say for the purpose of illustration that he concedes 1,000,000 bbl. will be supplied by other competing mills, not shown in the diagram. This leaves a market of 4,200,000 bbl. to be furnished by the three plants. Dividing 4,200,000 by 6,000,000 he can readily determine that if all three competing plants share the business they can not expect to operate at more than 70% capacity.

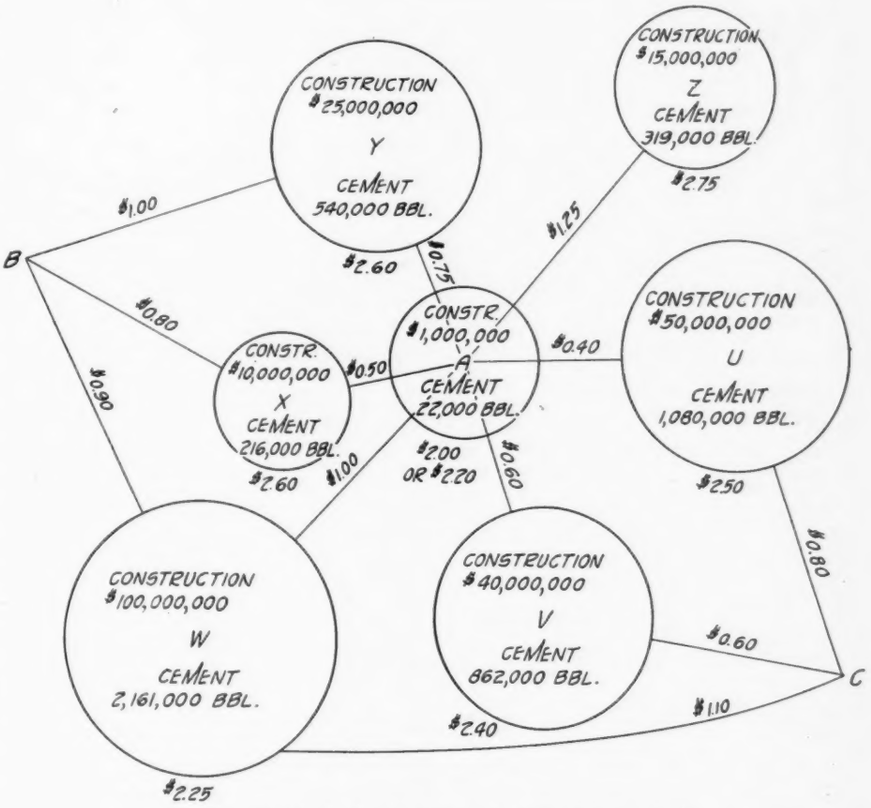
Planning to Make Money on Part Capacity

One great trouble in all our rock products industries is that they approach the next year's operation more or less blindly, guided by faith and hope rather than a clear vision of just what business may be expected and where. The result is that they gage their operations on operating at 100% capacity, and then moving heaven and earth to get rid of 100% capacity. If they do, and they do not have to cut prices below cost, they make money—at the expense of their competitors, who, incidentally will use every effort the following year "to get even"—thus is the entire market demoralized.

On the other hand, if each manufacturer were to systematically plan his entire year's operation on a 70% capacity basis, and plan it so that he would have a fair profit on 70% capacity operation, he would find that there are many economies in both operation and distribution which would compensate for the loss of volume. Then, of course, he is always able to expand his production, if the occasion demands, in a way to make a greater profit, but once embarked on a 100% capacity program, it is very difficult to cut costs to meet a situation which calls for only 70% of capacity.

Assuming that the reasonable and intelligent manufacturer, after a thorough analysis of all the facts and statistics, decides to be content with a 70% capacity business, if he has reasonable assurance that his competitors will also be satisfied with an equal percentage, he proceeds to analyze his specific markets to see how and where he can sell to net the most profit, considering all market factors, of which he himself is doubtless aware and is the best judge of.

Our diagram and accompanying tabulation is wholly hypothetical, and of no value, of course, except as a very crude illustration of how a cement-plant manager might go about it to analyze his market possibilities. The only point we are trying to make is this: That if every plant manager or business manager would (1) accurately determine his market possibilities in advance; (2) accept the fact that he can not operate 100%



Hypothetical chart of a typical market analysis

in a 70% market without the prospect of reprisals and price wars; (3) adjust his budget of production and sales to a 70% market; (4) and devote all his energies individually and with his competitors to enlarging the market at the expense of some competitive commodity, or by actually inspiring new construction not contemplated in the statistics; if the plant manager would do these four things as part of his scheme of operations, every one in the industry would be happier and more prosperous and, what is more important, the community and the public generally would be ultimate beneficiaries.

But we will say that conditions are such that a live, aggressive producer does not believe he should tag along with a competitor operating an obsolete or ill-managed plant. In this he should, of course, be guided

by the public welfare and his own judgment and understanding of economic law and of right and justice. The main point is that he should know his own and his competitor's market and price limitations so thoroughly that he knows just how far he can go without injury to his own business and without injury to the welfare of his industry or the public welfare. Such situations will eventually take care of themselves, as they do now, if no attempt is made to put a premium on inefficiency, and it is very unlikely that there will be such an attempt; and the re-adjustment is bound to be more equitable than under present competitive conditions.

Manufacturers' Statistical Bureaus

The kind of a statistical bureau we have outlined must not be confused with a statistical bureau within the industry. Such a manufacturers' statistical bureau has been often tried, some are still doing business, some have been put out of business for violation of the anti-trust laws, and several new ones are contemplated under an anticipated more liberal interpretation of the anti-trust laws in the future. Such statistical bureaus compile figures of production, stocks on hand, unfilled orders, contract prices, etc. Of course such statistics are very helpful in maintaining that thorough, exact knowledge of the state of one's own industry, so essential to its intelligent management. Doubtless we shall see many such statistical bureaus functioning in the near future.

The statistical bureau of an industry, or geographical districts of an industry, may or may not be an essential factor to its operation under such a construction statistical bureau as we have outlined. In any event it is a thing peculiar to its particular industry and must be maintained by its particular industry, or by a government bureau, such as those in the Department of Commerce. It will *not* serve the purpose of a co-operative construction statistical bureau.

Statistics Will Control Building of New Plants

Another great advantage of such thorough market analyses as we have outlined is that it would soon become impossible to finance new plants in market territories where bankers, or even the public, had access to, or were made familiar with, such statistics. The need or desirability of a new plant would have to be thoroughly proved in advance, just as the production and sales quotas of existing mills are determined in advance.

When shall we start?

Illustrating How a Sales Manager May Use Statistics to Map a Sales Campaign

Assumptions:

Total market	5,200,000 bbl.
Plant capacity (A, B and C)	6,000,000 bbl.
Conceded to other plants	1,000,000 bbl.
Total market for plants A, B and C	4,200,000 bbl.

Percentage of total mill capacity to be utilized = $\frac{4{,}200{,}000}{6{,}000{,}000}$ = 70% capacity

Plant A capacity	2,000,000 bbl.
70% capacity	1,400,000 bbl.
Manufacturing cost@$1.20	$1,680,000
Selling, advertising, overhead, etc.	250,000
Revenue required to regain costs	$1,930,000

	Analysis No. 1			Analysis No. 2		
	Quantity	Net price	Gross revenue	Quantity	Net price	Revenue
Home market—12-mile trucking zone	22,000 bbl.	$2.00	$ 44,000	22,000 bbl.	$2.20	$ 48,400
Market Z	100,000 bbl.	1.50	150,000	150,000 bbl.	1.50	225,000
Market Y	300,000 bbl.	1.85	555,000	270,000 bbl.	1.85	499,000
Market X	123,000 bbl.	2.10	258,000	150,000 bbl.	2.10	315,000
Market W	400,000 bbl.	1.25	500,000	250,000 bbl.	1.25	312,000
Market V	250,000 bbl.	1.80	450,000	431,000 bbl.	1.80	776,000
Market U	300,000 bbl.	2.10	630,000	200,000 bbl.	2.10	420,000
Total	1,495,000 bbl.	$1.73	$2,587,000	1,473,000 bbl.	$1.75	$2,595,400

EXPLANATORY NOTE. As stated in the foregoing text the figures here given are of no value except to illustrate one point. We presume the live manager would not be satisfied with two, or three analyses, but probably would make a dozen or a score. Probably he would want to carry the analysis much farther so as to be able to budget sales and production at least for quarterly periods. Then as the season develops he would have to keep his contemplated schedule constantly revised. However, he would have the fun of seeing which one of his preliminary estimates it came closest to fitting. It would be like playing golf. He not only plays against his opponents but against par, and against his own own hypothetical par.

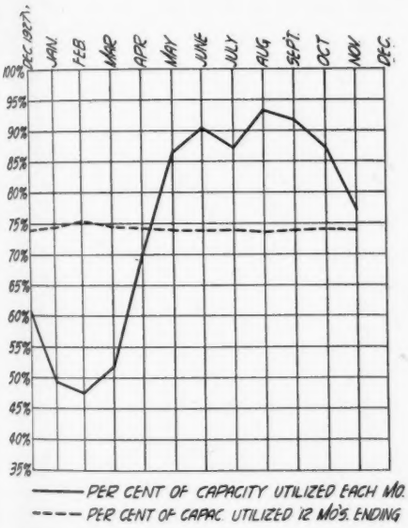
It is quite possible, of course, that some producers are already making market analyses in just this way. We claim no originality for the proposal. We do think, however, that the suggestion of cooperative construction statistical bureaus is new. At least we we have never seen the proposal made before. In any event we believe these suggestions are constructive and we offer them for criticism. The editors will be very glad to have criticisms and additional suggestions from any and all readers. The foregoing is indeed the result of readers' criticisms of our previous work.—The Editors.

The Portland Cement Industry in 1928 and Its Outlook for 1929

Increase in Capacity in 1928 Again Exceeds Gain in Shipments

WITH the November statistics of the portland cement industry at hand, and with a conservative estimate for December, it appears that portland cement production in 1928 was 177,000,000 bbl. and shipments 175,472,000 bbl.; a gain in production of approximately 2%, and in shipments also of 2% over 1927.

Except for two general localities conditions, while far from being entirely satisfactory to producers, were good enough to insure profits to most of the



Curves showing the per cent of capacity utilized each month and per cent of capacity for 12 months ending with each month

strong well-managed companies — several were unfortunate in being particularly hard hit by the import situation. The two localities which suffered most were the northeastern and southeastern sections, where the importation of approximately 2,500,000 bbl. of cement, mostly from Belgium, and the increased capacity of domestic mills, from several new plants and enlarged old plants were keenly felt.

Prices throughout the industry were probably appreciably less than in 1927, while in the northeastern section cement is said to have sold at prices that netted domestic mills less than $1 per bbl. at the plant. In the southeastern territory prices were probably in many instances on a level 50c per bbl. lower than last year, or probably netted the mills about $1.25 in some instances. Taking the estimated tonnages at these low prices into account we believe the average net mill price for the 175,472,000 bbl. shipped in 1928 was about $1.52 per bbl. giving the value of the year's shipments $266,727,000 as compared with $278,854,647 in 1927.

A tabulation of the consumption (approximate) by states in 1927, and our estimates for 1928 (based on U. S. Bureau of Mines figures for 10 months and estimates for 2 months) is shown herewith, which gives a clear picture of where both gains and losses in consumption were made—and why the industry had more troubles in some sections than in others.

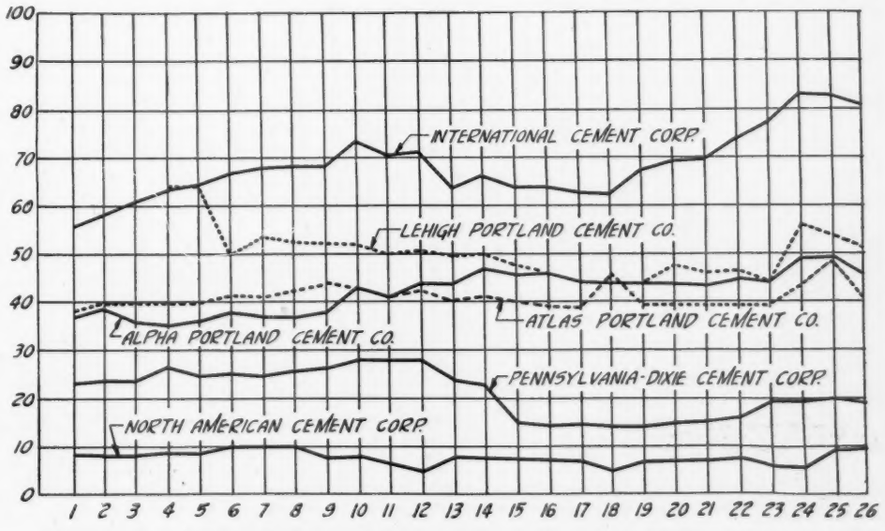
Present Capacity

The accompanying chart, based on U. S. Bureau of Mines statistics, shows the capacity of the industry utilized in 1928 each month, and the capacity utilized for the year ending with each month. From these it is apparent that not more than 75% of the industry's capacity to produce was utilized in 1928.

The U. S. Bureau of Mines listed 153 active and 2 idle plants at the end of 1927. During 1928 six new plants have contributed to the capacity and production of the industry. The total estimated capacity of these six new mills is at least 5,000,000 bbl., or 2,000,000 bbl. more than the increase in shipments in 1928. We believe we are safe in estimating that enlargements and improvements at existing mills added as much more to the capacity of the industry, so that the total increase in the capacity of the industry in 1928 was approximately 10,000,000 bbl. or 300% more than the gain in shipments. The estimated capacity of the 155 plants, at the end of 1927 was 227,000,000 bbl. At the end of 1928 the capacity of 161 plants must be in the neighborhood of 237,000,000 bbl., or 61,000,000 bbl. in excess of 1928 shipments.

Plants now building, as noted in the summary below, will add 9,100,000 bbl. to the capacity of the industry during 1929; and judging from the record of the last three years a percentage of increase in the consumption of portland cement in 1929 of about 2% or 3,500,000 bbl. is all that may be safely anticipated. This will leave the industry with an excess capacity at the end of 1929, leaving out of consideration entirely possible increases in capacity of existing plants, of 68,000,000 bbl. or 37½% in excess of prospective demand.

Of course, under these conditions, there are only two ways the industry can be generally prosperous—(1) Gage operations to a prospective 60% utilization of manufacturing facilities: (2) Eliminate the weaker, high cost mills from the industry. From present indications there is more probability of the latter alternative than the former, but the new year may



Range of typical portland cement company stocks on New York market—taken from 26 quotations (every two weeks beginning about January 3, 1928) pubished in successive issues of Rock Products

PORTLAND CEMENT MILL CAPACITY AND PRODUCTION IN 1927 AND 1928 COMPARED

District	Active plants 1927	Active plants 1928*	Capacity 1927	Capacity 1928*	Production 1927	Production 1928*	Per cent of capacity 1927	Per cent of capacity 1928
Eastern Pennsylvania, New Jersey and Maryland	24	26	47,074,000	49,000,000	42,687,200	40,000,000	90.7	82.0
New York and Maine†	11	12	15,760,000	17,000,000	10,775,375	11,500,000	68.4	68.0
Ohio, Western Pennsylvania and West Virginia	18	18	23,260,000	24,000,000	17,339,199	18,300,000	74.5	76.4
Michigan	15	15	18,591,000	19,000,000	13,965,241	13,800,000	75.1	72.8
Wisconsin, Illinois, Indiana and Kentucky	11	11	26,161,000	26,200,000	22,022,150	22,500,000	84.2	84.2
Virginia, Tennessee, Alabama, Georgia, Florida and Louisiana	18	19	21,846,000	23,000,000	16,016,154	16,100,000	73.3	70.0
Eastern Missouri, Iowa, Minnesota and South Dakota	11	12	20,357,000	21,000,000	14,358,201	16,600,000	70.5	79.1
Western Missouri, Nebraska, Kansas and Oklahoma	11	11	14,013,000	14,000,000	10,092,888	11,000,000	72.0	78.8
Texas	7	7	7,230,000	8,000,000	5,655,835	6,400,000	78.2	80.0
Colorado, Montana, Utah and Wyoming	8	11	5,592,000	7,000,000	2,179,241	2,700,000	39.0	38.6
California	12	12	21,813,000	22,000,000	14,580,654	13,800,000	66.8	62.8
Oregon and Washington	7	8	5,383,000	6,000,000	3,534,375	3,900,000	65.7	65.0
	153	160	227,080,000	236,000,000	173,206,513	176,700,000	76.3	75.0

*Our own estimates. †Maine began producing April, 1928.

CONSUMPTION OF PORTLAND CEMENT BY STATES IN 1926, 1927 AND 1928, SHOWING GAINS AND LOSSES FROM YEAR TO YEAR, IN BARRELS AND IN PERCENT

State	1926	Vital statistics of 1927: 1927	Gain	Per cent	Loss	Per cent	Vital statistics of 1928: 1928	Gain	Per cent	Loss	Per cent
Alabama	1,981,011	2,264,576	283,565	14.3			3,220,000	955,424	42.0		
Arizona	426,261	526,460	100,199	23.9			745,000	182,540	33.0		
Arkansas	769,808	855,051	85,243	11.0			1,300,000	444,949	52.2		
California	12,691,277	13,128,911	437,634	3.5			12,750,000			378,911	2.9
Colorado	1,138,301	1,002,396			135,905	13.0	1,127,000	124,604	12.4		
Connecticut	1,856,786	2,061,892	205,106	11.0			2,310,000	248,108	12.3		
Delaware	360,193	342,905			17,288	4.9	341,000			1,905	0.6
District of Columbia	907,342	981,732	74,390	8.2			841,000			140,732	14.3
Florida	4,373,917	2,482,725			1,891,192	43.2	1,230,000			1,252,725	50.5
Georgia	1,831,276	1,904,685	73,409	4.0			1,710,000			194,685	10.2
Idaho	443,737	311,226			132,511	29.0	309,000			2,226	0.7
Illinois	14,066,500	14,832,550	766,050	5.4			17,750,000	2,917,450	19.7		
Indiana	5,174,533	5,738,557	564,024	10.9			5,200,000			538,557	9.5
Iowa	2,826,839	3,708,471	881,632	31.2			5,380,000	1,671,529	44.2		
Kansas	2,286,661	2,432,055	145,394	6.3			2,320,000			112,055	4.6
Kentucky	1,659,087	1,953,629	294,542	17.8			1,662,000			291,629	15.0
Louisiana	1,187,453	1,490,560	303,107	25.5			1,280,000			210,560	14.1
Maine	548,155	505,952			42,203	7.7	522,000	16,048	3.2		
Maryland	2,318,564	2,651,700	333,136	14.4			2,225,000			426,700	16.1
Massachusetts	2,982,987	2,820,132			162,855	5.4	2,910,000	89,868	3.2		
Michigan	10,784,049	11,576,188	792,139	7.3			11,700,000	123,812	1.1		
Minnesota	3,572,711	3,380,002			192,709	5.4	3,210,000			170,002	5.0
Missouri	5,201,961	4,207,151					1,090,000	109,209	11.1		
Mississippi	804,351	980,791	176,440	21.9	994,810	19.1	4,810,000	602,849	14.3		
Montana	257,741	307,968	50,227	19.5			454,000	146,032	47.4		
Nebraska	1,554,967	1,360,032			194,935	12.5	1,165,000			195,032	14.3
Nevada	94,644	87,276			7,368	7.8	113,000	25,724	29.2		
New Hampshire	438,350	459,706	21,365	4.8			518,000	58,294	12.6		
New Jersey	7,116,109	8,419,323	1,303,214	18.3			8,360,000			59,323	0.7
New Mexico	192,718	278,528	85,810	44.5			345,000	66,472	23.7		
New York	20,224,702	23,002,585	2,777,883	13.7			22,100,000			902,585	3.9
North Carolina	3,731,959	3,213,314			518,645	13.9	2,270,000			943,314	29.1
North Dakota	402,546	392,730			9,816	2.4	446,000	53,270	13.5		
Ohio	9,683,538	10,342,424	658,886	6.8			10,680,000	337,576	3.3		
Oklahoma	2,343,201	3,119,565	776,364	33.2			3,240,000	120,435	3.8		
Oregon	1,318,252	1,399,167	80,915	6.1			1,270,000			129,167	9.2
Pennsylvania	13,839,552	13,837,359		0.0	2,193	0.0	12,800,000			1,037,359	7.5
Rhode Island	634,626	700,851	66,225	10.4			742,000	41,149			
South Carolina	638,972	985,874	346,902	54.4			1,625,000	639,126	64.8		
South Dakota	423,831	409,820			14,011	3.3	489,000	79,180	19.3		
Tennessee	1,933,409	2,262,697	329,288	17.0			2,750,000	487,303	21.6		
Texas	4,877,987	5,437,907	559,920	11.4			6,400,000	962,093	17.7		
Utah	461,338	428,469			32,869	7.1	512,000	83,511	19.5		
Vermont	271,615	393,294	121,679	45.0			619,000	225,706	57.5		
Virginia	1,733,734	1,799,062	65,328	3.8			1,980,000	180,938	9.6		
Washington	2,021,986	2,574,293	552,307	27.3			2,841,000	266,707	10.4		
West Virginia	1,679,574	1,561,978			117,596	7.0	1,234,000			327,978	21.0
Wisconsin	4,621,975	5,553,176	931,201	20.1			5,180,000			373,176	6.7
Wyoming	188,590	181,103			7,487	3.9	205,000	23,897	13.2		
Unspecified		51,818					50,000				
Exported		1,128,112					1,142,000				
Totals		171,864,728					175,472,000				

see a change of tactics or of judgment, or of sentiment, if there is such a thing in business. Many mills were very close to actual cost of production, or less, in 1928.

Significant Developments

Our records, or news notices, verified where possible, during the year show 12 plants in various stages of construction or development. Arranged alphabetically below, the developments at existing plants are given not as complete, but as significant of the trend of the industry as a whole:

Alabama (subsidiary of the International). Completed conversion to wet process of original Phoenix plant at Birmingham, Ala., and made many other changes and improvements. Took over the operation of the **Warrior** as Alabama Plant No. 2.

Alpha.. At Martins Creek, Penn., has revised and increased its grinding equipment by installation of new Bradley Hercules mills as preliminary grinders, and 7 x 26 ft. Traylor compartment mills. At Ironton, Ohio, extensive reconstruction, particularly of mine features, and raw and clinker handling departments. At La Salle, Ill., the installation of "Norblo" dust-collecting equipment and other improvements. On May 1 the Alpha purchased the **Phoenix** plant at Birmingham, Ala.

Basic (Products Co.) reported to have doubled the capacity of Kenova, W. Va., plant, which began production in 1927. Estimated present capacity 1,000,000 bbl.

Beaver. Quarry and shale-pit improvements and extensions; new loading facilities for bulk cement; new hydro-electric power plant.

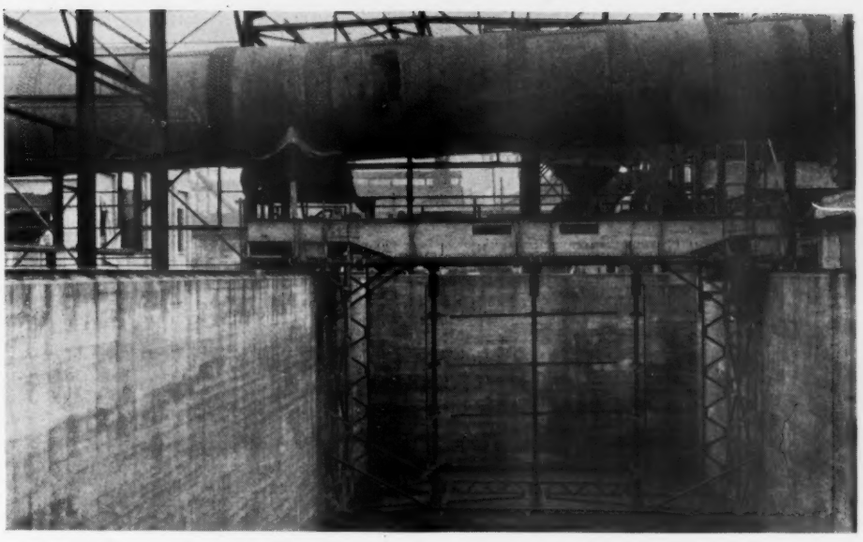
California. Reported to have replaced five small dry-process kilns with two 10 x 204-ft. wet-process kilns; new silos; dust-collector installation, etc.

Colorado. Began production of new product, hydro-plastic waterproof portland cement.

Columbia (Division, Pittsburgh Plate Glass Co.) Completed installation of Oliver filters to filter all slurry, and incidental changes.

Crescent. Old dry-process plant completely remodeled and rebuilt. Fuller-Kinyon dry-blending system installed.

Dewey. Added a third kiln (11x175-ft., Allis-Chalmers), waste-heat boiler (Edge Moor 917 hp.), third Allis-Chalmers compeb mill, and incidental equipment; also additional storage for finished cement; making total storage over 300,000 bbl., Sly dust-collectors installed. Added capacity of plant estimated at 500,000 bbl., making present capacity of 1,500,000 bbl. Also began production of commercial crushed stone.



Slurry basin at the new "velo" plant of the Missouri Portland Cement Co.

Federal. Installed the W. W. Sly cement-cooling system, similar to the one installed at the plant of the Bessemer Limestone and Cement Co., Bessemer, Penn., several years ago.

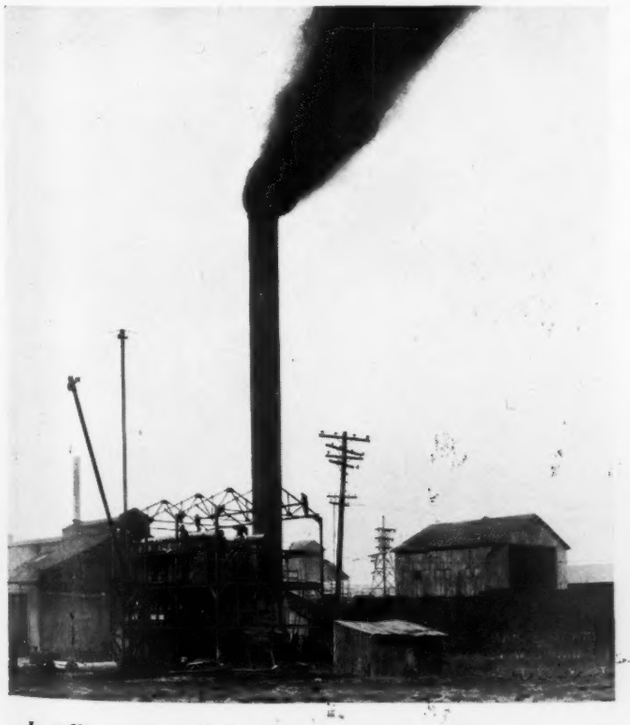
Georgia. (Cement and Stone Co.), reported to have made extensive improvements, including new stone plant.

Giant. Built a two-story concrete building for welfare and community center.

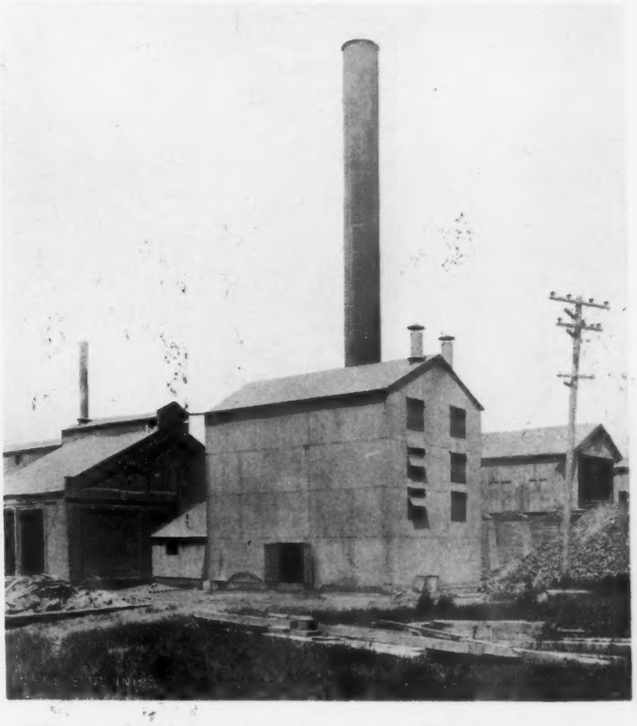
Great Lakes. Installed "Norblo" dust-collecting system; is completing a 150,000-ton storage and packing plant at Cleveland, Ohio, to receive bulk shipments by water from Buffalo, N. Y., plant.

Hercules. Added Sly dust-collector equipment.

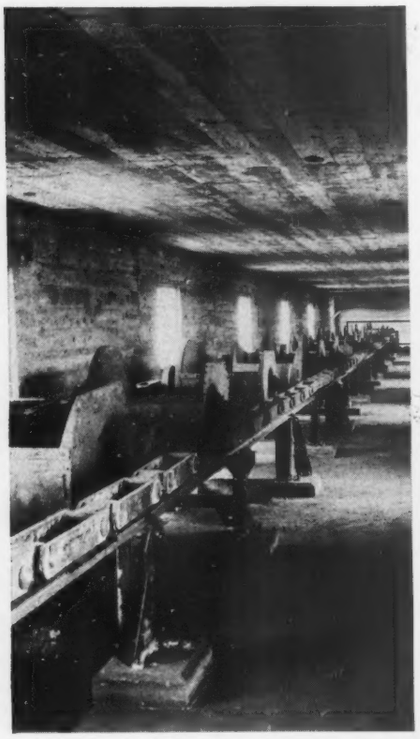
Huron. Added another (fourth) Edge Moor waste-heat boiler (1,037 hp.) and other improvements. Has completed a 125,000-bbl. storage and packing plant at



Installing a new dust collecting system on the dryer stack at the plant of the Lawrence Portland Cement Co., at Siegfried, Penn.



The completed dust collecting unit at the Lawrence plant. Note the absence of smoke from the dryer stack, in comparison with the amount shown in the opposite picture



Conveyor discharging to raw storage silos at the Missouri Portland "Velo" plant

Buffalo, N. Y., to receive cement by water from Alpena, Mich., plant.

Indiana (subsidiary of International). Installed a fourth kiln, added grinding equipment; Sly dust collectors; perfected manufacture of new quick-hardening portland cement known as "Incor." Added potential capacity estimated at 500,000 bbl.

International. Purchased the Nazareth, Penn., plant of the **Phoenix** and

The rock and clinker storage with its overhead crane, and the train terminal and crusher, at the Northwestern plant

the Demopolis, Ala., plant of the **Warrior.** Began the manufacture and marketing of new quick-hardening cement known as "Incor" at several mills.

Keystone (Portland Cement Co.). A new comer, which began production in August (described in Rock Products, October 13); wet process; notable as the first American installation of considerable equipment of German design (Polysius Corp.); two 10 ft. x 13 ft. 3 in. x 250 ft. kilns; estimated capacity, 1,000,000 bbl.; now being doubled.

Knickerbocker. (Subsidiary of International). Sly dust-collectors added.

Slurry tanks of the plant of the Northwestern Portland at Grotto, Washington

Lawrence. Thomaston, Me., plant completed and put in operation, (described in Rock Products, November 10); two wet-process kilns 11x200 ft.; estimated capacity, 1,000,000 bbl. At the Seigfried plant the company installed the "Norblo" system of removing moisture from the raw-material bins and from the raw-material dryers.

Lehigh. Increased the raw grinding equipment at Mitchell, Ind., plant by

Kiln under construction at the Northwestern plant. Note the single rolls and closed gear trains

three Bradley Hercules mills. Completed conversion of Mason City, Iowa, plant to wet process. Probably other changes at various plants.

Louisville. Installed Sly dust-collecting equipment at Speeds, Ind., plant.

Louisiana. (Subsidiary of International), added largely to its marine equipment for transporting limestone from St. Stephens, Ala., to New Orleans.

Manitowoc. Filter installation (Filtration Engineers, Inc.) completed, also "Norblo" dust-collection system installed, and additional Hercules mills on finish end.

Bird's-eye view of the Northwestern Portland Cement Co. plant from the clay field

Marquette. "Norblo" dust-collection system installed at LaSalle, Ill., plant; added another Edge Moor waste-heat boiler (989 hp.) making eight in all (7912 hp.). Opened new quarry at Cape Girardeau, Mo., plant and increased grinding capacity by addition of Hercules mills. Is reported about to establish storage and packhouses at Memphis, Tenn., and possibly other Mississippi river points.

Missouri. Completed in November a new plant at St. Louis, Mo., specifically to make "Velo" high early strength, or quick-hardening cement, sold under the trade name "Prestolith"; one kiln 11 ft. 3 in x 10 ft. x 311 ft., wet process. Has several unusual features, including F. L. Smidth "Pyrator" for coal drying, "Unidan" compartment mills and "Cylcup" conveyors. Estimated capacity 500,000 bbl.

Monolith. Monolith, Calif., plant equipped Sly dust-collectors.

Nazareth. Installed three Edge Moor waste-heat boilers (1240 hp. each); "Norblo" dust-collection system; increased grinding capacity with Hercules mills.

New Egyptian. Combined with Peerless, under name of Peerless-Egyptian. L. A. Beeghly interests in control.

North American. Installed Edge Moor waste-heat boilers and power plant consisting of two 3,000 kw. General Electric turbo-generator at Security, Md., as part of an extensive improvement program. Sly dust collectors added to Security, Catskill and Alden plants.

Northwestern (Portland Cement Co.). New comer, built plant at Grotto, Wash., which began production in April; wet process; 7x40 ft. Traylor compartment mills; 11x240 ft. kiln; 600,000-bbl. capacity.

Northwestern States. Opened Gilmore City, Iowa, plant after making improvements. Added one Edge Moor 1,088 hp. waste-heat boiler, making five in all (4,660 hp.) at Mason City, Iowa, plant.

Oklahoma. Reported to have developed three or more gas and oil wells at Ada, Okla., plant.

Olympic. Finished installing of third kiln; began the manufacture of rapid-hardening cement "Velo"; extensive changes and improvements, including new crushing plant, reported to have doubled capacity; from 500,000 to 1,200,000 bbl.

Oregon. Installed second kiln at Lime, Ore., plant, doubling capacity from 400,000 to 800,000 bbl.; built warehouse and office building in Portland, Ore.

Pennsylvania-Dixie. Bought **Pyramid** plant at Des Moines, Ia.; made changes and improvements increasing capacity 33 1/3%—from 1,000,000 to 1,300,000 bbl. Completed changes and improvements at No. 3 plant, Richards City, Tenn., where two wet-process kilns, 11 ft. 3 in. x 10 ft. x 343 ft., replaced a number of smaller kilns (described in Rock Products, May 26); kilns equipped with F. L. Smidth and Co. "Unax" coolers.

Peerless-Egyptian. Detroit plant installed "Norblo" dust collectors.

Petoskey. Building a storage and packing plant at Milwaukee, Wis. At Petoskey, Mich., plant, installed Brad-

New waste-heat installation at the Security, Md., plant of the North American Cement Corp.

ley Hercules mills as preliminary clinker grinders.

Phoenix. Nazareth, Penn., plant sold to International Cement Corp., now the **Lone Star.** "Norblo" dust collectors and other equipment added.

Phoenix. Birmingham, Ala., plant sold to Alpha Portland Cement Co. "Norblo" dust collector added.

Pyramid. Sold to Pennsylvania-Dixie, at receivers' sale.

San Antonio. Power-house extension and new grinding equipment installation completed.

Sandusky. Dixon, Ill., plant, improvements included a new power plant, four 1,000-hp. Edge Moor, waste-heat boilers; Fuller-Kinyon pumping system; 400,000-bbl. storage silos. York, Penn., plant (white cement) improved, including slurry filter installation. New plant at York to make gray cement from former quarry waste completed; two kilns, wet-process, American slurry filters; estimated capacity 1,000,000 bbl. Name recently changed to Medusa Portland Cement Co.

Southwestern. Osborn, Ohio, installed additional Sly dust-collecting equipment.

Superior (subsidiary of Wellston Iron Furnace Co.). "Norblo" dust-collection system installed, kilns enlarged and capacity doubled. Began manufacture of a colored cement.

Three Forks. Made many changes and improvements at two Montana plants and began operation after long shut-down.

Trinity. Bought extensive clay resources near Houston, Texas. Doubling capacity of Fort Worth, Texas, plant; 11 x 250 ft. kiln, 8 x 30 ft. and 8 x 40 ft. Traylor compartment mills. Capacity increased from 600,000 to 1,200,000 bbl.

Universal. Improvements at Buffington, Ind., plant included erection of 301½ ft. reinforced concrete stack. Reported to be adding to dust-collection installation.

Valley Forge. Installing Cottrell electrical precipitation system.

Volunteer. New comer, whose plant was (described in Rock Products, July 21), placed in production in June. Capacity 1,000,000 bbl.

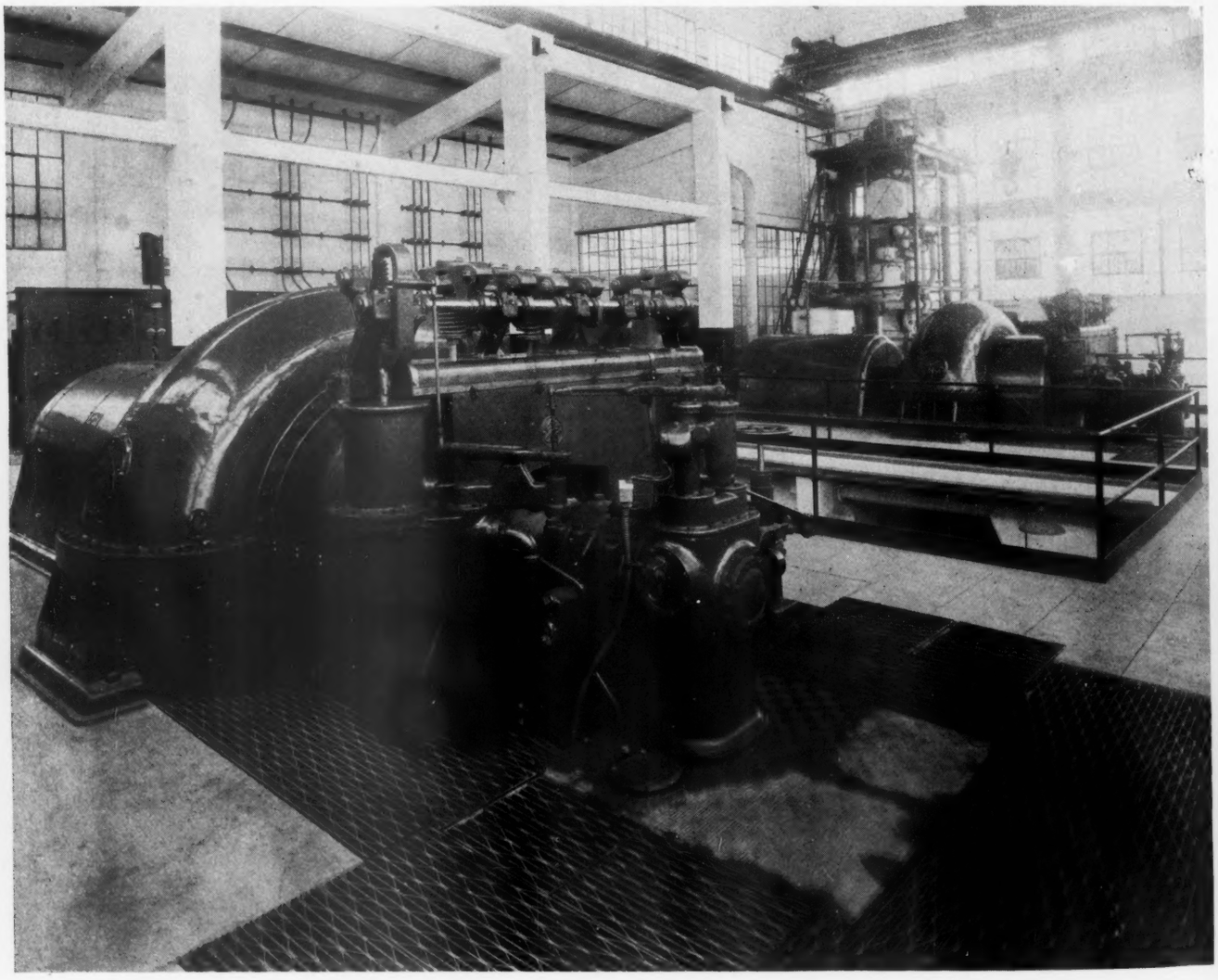
Wabash. Installed "Norblo" dust-collecting system.

West Penn. Installed a second Allis-Chalmers kiln 11 ft. 6 in. x 15 ft. x 250 ft. —the largest diameter of any kiln in the world. The dust-collection equipment is new in this country—the Davidson, installed by the American Blower Co. The Allis-Chalmers rotary cooler is 9x90 ft., of special design, by O. J. Binford, general manager of the West Penn Cement Co. Compartment mills (Allis-Chalmers) are 9½x8x38 ft. Increased capacity 750,000 bbl.

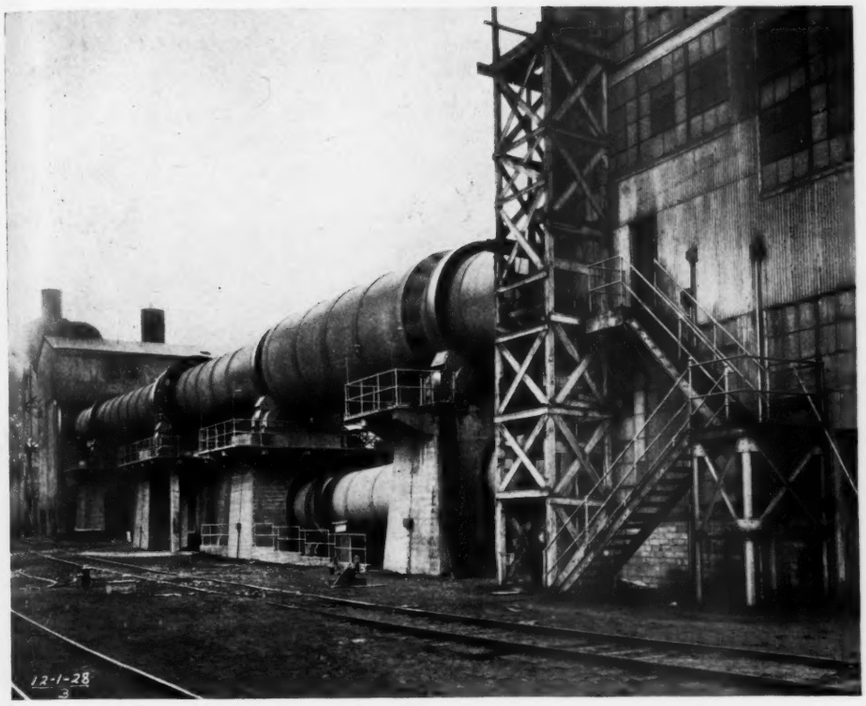
Wolverine. Reported to be installing slurry filters (Filtration Engineers, Inc.)

Summary of New Mills in 1928

April—Lawrence	1,000,000 bbl.
April—Northwestern	500,000 bbl.
June—Volunteer	1,000,000 bbl.
August—Keystone	1,000,000 bbl.
November—Sandusky	1,000,000 bbl.
December—Missouri	500,000 bbl.
Year's total	5,000,000 bbl.



Latest in waste-heat, cement-mill, power plants; Security, Md., plant of the North American Cement Corp.



New 11-ft. 6-in. by 15-ft. by 250-ft. kiln with a 9x90-ft. cooler at the plant of the West Penn Cement Co. near Butler, Penn.

Nearby Plants

There was also much activity at plants in Canada, Cuba and Mexico, as follows:

Canada. Converted Winnipeg, Man., plant from dry to wet process; two 10 x 8 ft. Traylor kilns. Now converting Hull, Que., plant to wet process; 11 ft. 3 in. x 365 ft. Traylor kilns—the longest yet made. Wet process changes by F. L. Smidth and Co.

Cuban (subsidiary of International) Hercules mills installed for both raw and finish preliminary grinding—including special adaptation of Hercules mills for wet grinding.

Landa (Mexico). Extensive changes and improvements.

La Tolteca (Mexico). Added Hercules mills to grinding equipment.

Novella (Guatemala). Added Hercules mills.

Plants Under Construction

According to most recent information, the following plants are actually under construction:

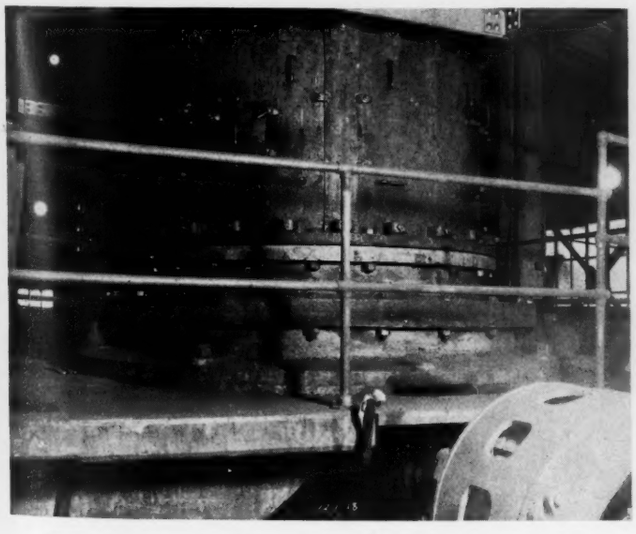
American (Portland Cement Co.), Foreman, Ark., a project mentioned as such in our review of 1927. We are unable to verify persistent rumors that some construction work has been done and that an all-welded steel kiln 11 ft. 3 in. x 300 feet. has been fabricated for this plant. Estimated capacity 600,000 bbl.

Arkansas (Portland Cement Co.), Okay, Ark., has started construction of a new mill near Saratoga, Ark. This is a subsidiary of the Ideal Cement Co., Denver, Colo. The new plant will have an initial capacity of about 600,000 bbl. It will use the wet process, having one kiln 11 ft. 6 in. by 300 ft. and two 8 x 7 x 40 ft. compeb mills, each driven by 800 hp. "Hi-Tork" synchronous motors, all manufactured by the Allis-Chalmers Manufacturing Co. The primary crusher is a "Penn, Jr." Pennsylvania Crusher Co.'s. hammer mill, which will reduce the quarry rock to compeb-mill feed in one operation.

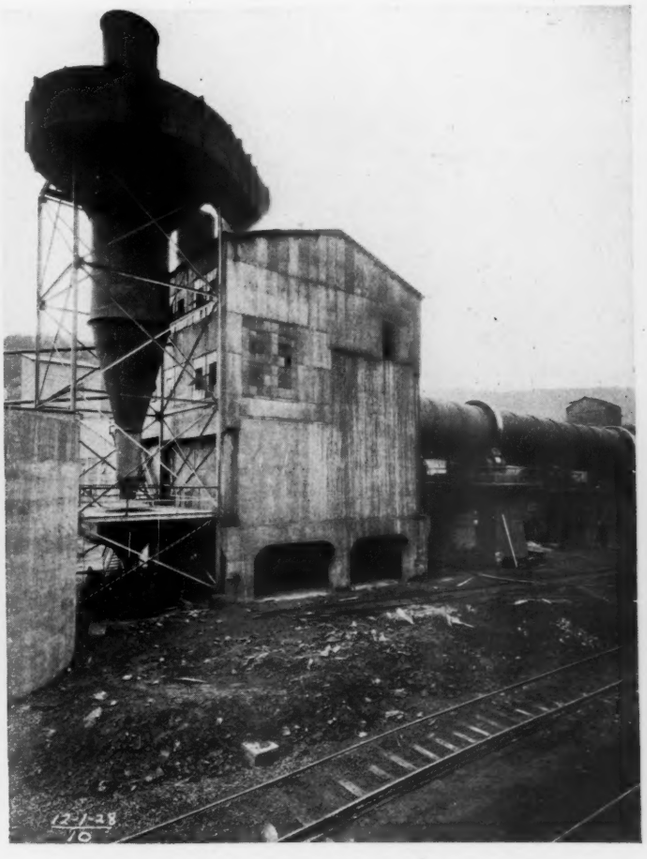
Ash Grove. New plant at Louisville, Neb., near Omaha, is nearly completed. Wet process; two 260 ft. kilns. Estimated capacity 1,000,000 bbl.

Atlas. Building a new wet-process plant at Waco, Texas; estimated capacity 600,000 bbl. One 11x250-ft. kiln and 10x 142-ft. cooler, with compeb mills for grinding (all Allis-Chalmers).

Basic (Products Co.). Affiliated with the Davison Coke and Chemical Co., will operate a new plant now under construc-



New 70-in. coal mill at the Butler, Penn., plant of the West Penn Cement Co.



Dust collector installed on the exhaust stack of large kiln at West Penn

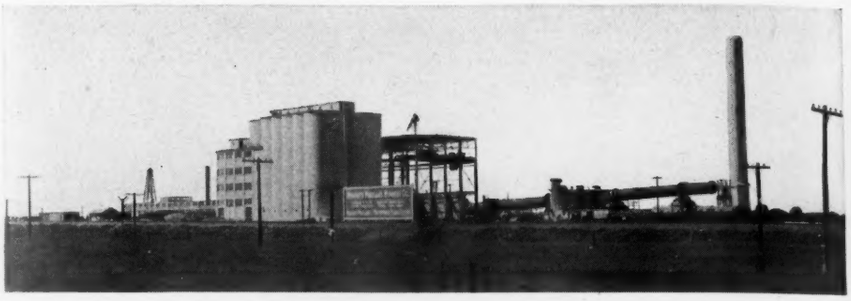
tion on Neville Island, below Pittsburgh, Penn., which will use byproduct slag and waste gas from coke ovens. The Allis-Chalmers Manufacturing Co. has contract for design and equipment. The kilns are to be 10x175 ft., coolers 8x80 ft., with 26-ft. compeb mills. The slurry will be filtered with Oliver-United filters; wet process; estimated capacity 1,000,000 bbl.

Idaho (Portland Cement Co.). A new comer in the industry, building a one kiln (10 x 200 ft.) wet-process plant near Pocatello, Idaho; 7 x 30 ft. compeb mills; equipped by Allis-Chalmers Manufacturing Co. Expect to be in operation April, 1929. Estimated capacity, 500,000 bbl.

Kentucky. (Cement Corp.). A new comer, reported at this writing, to have begun the construction of a wet-process plant near Frankfort, Ky. Estimated capacity 1,400,000 bbl.

Marquette. Is erecting a new dry-process plant at Oglesby, Ill., two 11 ft. 3 in. x 200-ft. kilns, one 8 x 7 x 47 ft. compartment mill, two 8 x 7 x 50-ft. compartment mills and 9 x 90 ft. rotary coolers (all Traylor Engineering and Manufacturing Co.). These units are all equipped with Timken roller bearings. There are three Edge Moor waste-heat boilers (1476 hp.). The new plant will use the Fuller-Kinyon system of dry blending and be completely equipped in every department with "Norblo" dust-collectors. It will be the second dry-process plant out of a score of new ones in the last two or three years, and is expected to be the last word in dry-process design and construction. Estimated capacity 1,000,000 bbl.

Monolith Midwest. A new comer, whose plant near Laramie, Wyo., is expected to be in production in January, 1929. Designed and erected for the same interests as own and operate the Monolith Portland Cement Co. (Los Angeles, Calif.) by F. L. Smidth and Co. One kiln, wet-process, 11 ft. 6 in. x 10 ft. x 343 ft. Will manufacture plastic cement also, using an entirely independent conveyor system. Estimated capacity, 600,000 bbl.



General view of the plant of the Monolith Portland Midwest Co. at Laramie, Wyo., which is rapidly nearing completion

National (Portland Cement Co.). Recently incorporated at Houston, Texas, to make white cement. Plant reported under construction. Estimated capacity, 200,000 bbl.

Pacific Coast (Cement Co.), Seattle, Wash., waterfront plant of this new company is nearly ready to operate; two 11 ft. 3 in. x 240 ft., Traylor kilns, wet-process, 9 x 90 ft. rotary coolers, 7 x 45 ft. Traylor compartment mills. Estimated capacity, 1,000,000 bbl.

Republic (Portland Cement Co.), San Antonio, Texas, is building a new wet-process plant, two 11 x 250-ft. kilns, 10 x 100-ft. coolers, 8 x 7 x 40 ft. compartment mills (all Allis-Chalmers). Estimated capacity, 1,000,000 bbl.

Summary of Plants Under Construction

American*	**600,000 bbl.**
Arkansas	**600,000 bbl.**
Ash Grove	**1,000,000 bbl.**
Atlas	**600,000 bbl.**
Basic	**1,000,000 bbl.**
Idaho	**500,000 bbl.**
Kentucky	**1,000,000 bbl.**
Marquette	**1,000,000 bbl.**
Monolith Midwest	**600,000 bbl.**
National*	**200,000 bbl.**
Pacific Coast	**1,000,000 bbl.**
Republic	**1,000,000 bbl.**
Total under construction	**9,100,000 bbl.**

*Doubtful as to authenticity of construction reports.

Projected Plants

The number of projected plants has dwindled considerably since a year ago. The following list, however, probably is not a complete one:

Bessemer. Expects to start construction of plant at or near Chicago in near future—estimated capacity, 1,000,000 bbl.

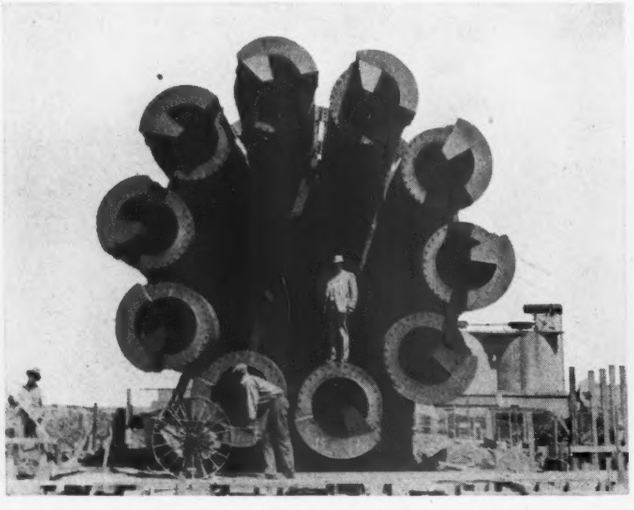
California (White Portland Cement Co.) was incorporated for $1,000,000. Location of plant not divulged, but said to be near Stockton, Calif.

Carolina. Still reported as a possibility, at New Bern, N. C.—estimated capacity, 1,000,000 bbl.

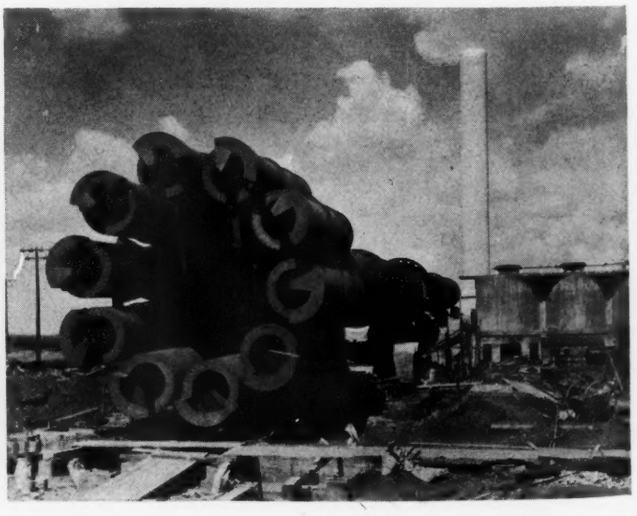
Commonwealth. Changed the prospective location of mill from North Adams, Mass., to North Pownal, Vt.—estimated capacity 1,000,000 bbl.

Georgia. Office shops and laboratory completed at Sandersville, Ga. Trouble with railway connections reported to have held up project—500,000 bbl. estimated capacity.

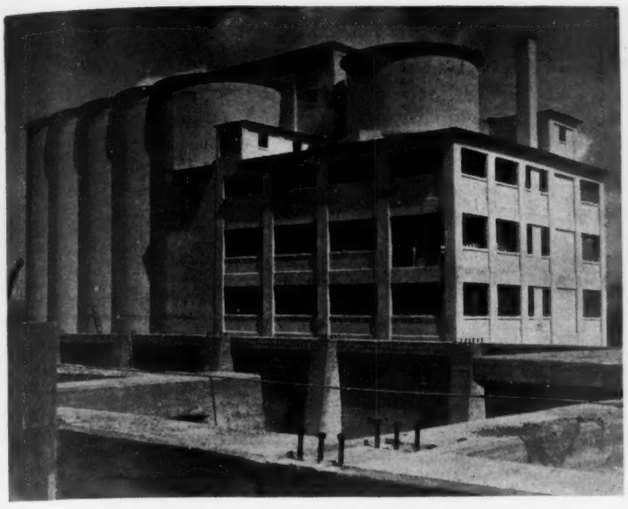
Guadalupe (Portland Cement Co.),



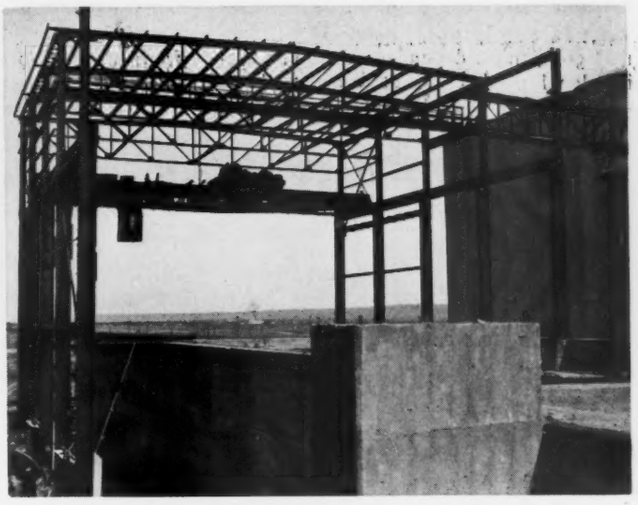
Kiln of the Monolith Midwest Portland Co.'s new plant



Another view of kiln and coolers of new Midwest plant



Packhouse of the new Laramie plant of the Monolith Midwest company



Storage bins and overhead crane complete at the Monolith Midwest plant

San Jose, Calif., project for a 1,000,000-bbl. plant said to be still alive.

Los Angeles (Mountain Park Co.) has project for plant on Santa Monica Bay—estimated capacity, 1,000,000 bbl.

Mathieson Alkali Works. Reported to be still contemplating erection of portland cement plant at Saltville, Va. E. M. Allen, president of the Mathieson Alkali Works, was recently elected a director of the International Cement Corp.

Monolith. Under name of Monolith Portland Gulf Co., has acquired property at Arkansas Pass, Texas—estimated capacity, 500,000 bbl.

Newago. Has project to build a 1,000,000 bbl. plant at Charlevoix, Mich.

Outstanding Technical Developments

The tendency toward very large kilns took another step in 1928 with the installation of the 15-ft. diameter (calcining zone) kiln at the West Penn Cement Co. plant, and the order for a 365-ft. kiln for the Hull plant of the Canada Cement Co., Ltd. Very large compartment mills—7 x 8 x 40 ft., or more—were installed in most of the new plants. Rotary coolers 9x90 ft. and 10x100 ft. are getting to be commonplace in new installations. There were great strides made at many plants in increase of grinding equipment—a reflection of the race to make a finer ground product, finer ground raw materials, and, incidentally, high early strength cements. Waste-heat power and dust-collecting installations were also notable in the year's developments.

Reduction of Labor Requirements

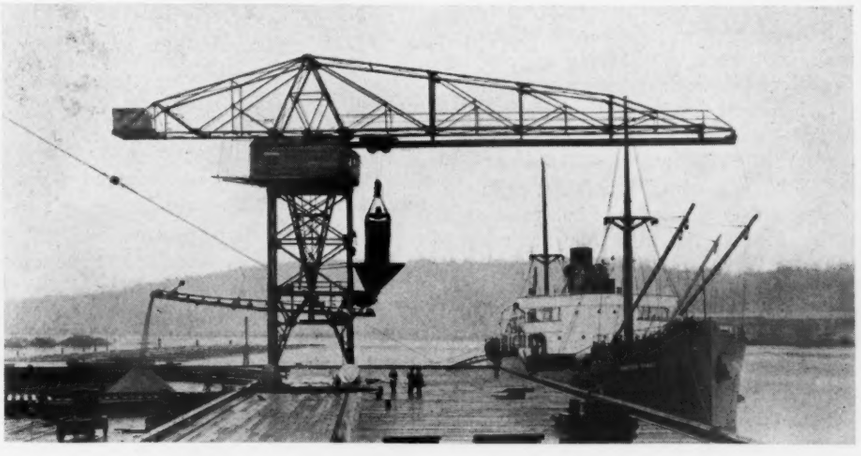
One result of large machinery units, electrification of plants, pneumatic conveying, etc., has been a continuous decrease in labor requirements per barrel of cement manufactured. According to United States Bureau of the Census figures published in Rock Products, December 8, the average number of wage earners to make 161,658,000 bbl. of cement in 1925 was 38,437, at 145 plants; in 1927 to make 173,206,513 bbl. at 161 plants required 36,292 wage earners (average number for the year). In other words there was an average of 265 laborers to the plant in 1925 and 225 in 1927. Estimating 3000 hours per man per year, we have in 1925 the number of barrels per man-hour equal to 1.4 as compared to 1.6 in 1927.

This tendency to increase production per man-hour will be more and more noticeable as the percentage of new plants increases, because in some of the newest plants less than half the number of laborers are required that was considered necessary but a few years ago. Expressed in another way, it is reasonable to believe that many of the newest plants can fine grind and make a quicker hardening product at no more cost than many of their older competitors can make a standard specification product.

Consolidations

The year 1928 was marked by several notable consolidations. The International Cement Corp.'s purchase of the Nazareth, Penn., plant of the Phoenix and the Warrior, Ala., plant of the Warrior; the merging of the New Egyptian and Peerless companies; the purchase of the Phoenix, Birmingham, Ala., plant by the Alpha Portland Cement Co.; the purchase of the Pyramid plant at Des Moines, Iowa, by the Pennsylvania-Dixie Cement Corp., were outstanding examples. A proposed merger of the Pennsylvania-Dixie and the North American Cement Corp. failed to materialize.

The tendency of the Portland Cement industry to become localized, with smaller and smaller market territories per plant continues very markedly. This has its disadvantages in the case of small companies operating a single mill, as can be clearly seen by reference to the accompanying tables which Rock Products has compiled showing the fluctuations in



Completed dock and unloading crane for handling Alaska limestone at the plant of the Pacific Coast Cement Co. at Seattle

demand and consumption by states from 1926 to 1928 inclusive. The single-mill companies, dependent on a fluctuating local market are at a great disadvantage compared to large organizations which can use local mills to supplement production of other mills in more remote markets where demand may be strong, or may temporarily close local mills or cut their production, without entailing serious loss to the organization as a whole.

Portland Cement Research

Is the Industry Satisfied with Present Product? Our Investigation Shows It Is Fully Alive to the Possibility of Improvement

THERE IS a disposition in some quarters to criticize the portland cement industry, as a whole, with being too well satisfied with its present product; and a disposition to criticize portland cement plant chemists as routine in their work and not very imaginative or inquisitive in regard to obtaining a better control of their product, if not a better product. To satisfy ourselves we undertook to find out in a general way how many portland cement companies are doing research work on their own account, and the general nature of such research.

The results speak for themselves. The portland cement industry need make no apologies to anyone. Few chemists in any industry know much about mineralogical chemistry, or geochemistry. The chemistry of metallurgy, which is closely allied, probably, to cement chemistry, has been a hundred years developing and only recently became anywhere near an exact science. The chemistry of cement, one may safely say, is just beginning to be understood, in spite of much literature, more or less confusing and controversial; but its progress toward an exact science probably will be rapid in the next few years.

Everyone in the industry, of course, is familiar with the fundamental research work on portland cement being done at the U. S. Bureau of Standards in Washington by the Portland Cement Association under Dr. R. H. Bogue. There are some manufacturers who believe this work is all the research work that industry needs to do, at least until it has proceeded so far that individual company work may consist only of applying these findings. Such reasoning is not in line with industrial development generally. Co-operative research work can never remove the necessity for individual company research. The work of Dr. Bogue is in the realms of pure science. The individual companies must translate it into applied science, so far as their own materials are concerned, if they would ever "cash in" on the fundamental facts established.

There is no reason why even research on such a fundamental subject as the "constitution of portland cement" should be confined to the Bureau of Standards laboratory. Every cement plant chemist must sooner or later acquire an intimate knowledge of the constitution of cement, and the quickest and surest way is for him to do research on it himself. There is plenty of opportunity for him, as well as the Bureau of Standards, to make original discoveries; and no industry is better organized and manned to co-ordinate such independent research and to utilize to the advantage of all concerned facts of little significance perhaps in an individual case, but important intregals in the summation or understanding of the other facts. The more intelligent independent research the quicker will commercial results follow present association research accomplishments.

One thing, we believe, Dr. Bogue's work has done, that eventually will mean the salvation of the industry, and that is to make cement chemists more appreciated in their own organizations. His demonstration and proof of the intricate and involved nature of the chemistry of cement can mean only that high grade chemists are necessary to unravel the truth and apply cement chemistry successfully.

Returns from 50 Companies

Returns from 50 portland cement companies—more than half of all in the United States and Canada—show that every one of these 50 is doing some kind of original research work. Some general comments by cement chemists on research work in general follow:

* * * *

"Every cement chemist must do research because of production costs."

* * * *

"We do approximately as much research as routine."

* * * *

"One man now full time on research."

* * * *

"We are continually working on a better way to make cement better."

* * * *

"We are doing chemical research to make a better product."

* * * *

"One man continuously and sometimes as many as three are on research."

* * * *

"Have been doing research for the last two years."

* * * *

"We have a special research department."

"We are making a petrographic study of clinker, free lime and of a method of chemical analysis."

* * * *

"We are engaged in systematic research covering every step in the process."

* * * *

"We do a small amount of research."

* * * *

"We have a chemical research laboratory and an engineering research laboratory."

* * * *

"Yes, on specification test methods, special burns, plasticity, workability, contraction and expansion, particle sizes."

* * * *

High Early Strength Cement

Naturally, as one who has following developments in the industry the last two or three years would expect, the most popular subject of research is high early strength, or quick-hardening, cement. Of the 50 companies reporting, 36 admitted research along these lines. Twelve companies are not doing any of this kind of research and two are noncommittal. Some typical comments on this phase of research are:

"Partially on high early strength."

* * * *

"Some; much more on long-time strength or permanent concrete."

* * * *

"On high early strength cement that does not retrogress at later ages."

* * * *

"Not as a primary object."

* * * *

"Rather to make a better all round cement."

* * * *

"Rather to develop highest potential early strength consistent with ultimate strength and durability of standard product."

* * * *

"Our cement always has been an early high strength product."

* * * *

"All our research is to that end."

* * * *

"We have done some work along this line, more particularly the adaptation of good portland cement for use in high early strength concrete."

"Some on this problem."

* * * *

"We have already developed a high early strength cement."

* * * *

"Only a part of our work."

* * * *

"No; to obtain a perfectly balanced cement."

* * * *

"No; to perfect a product already a high early strength cement."

* * * *

"No, but the subject receives attention."

* * * *

"No, our information indicates common strength ceilings at earlier ages than we like. These may indicate a poor strength-age curve."

* * * *

A Better All-Round Cement

We have always contended that the research work in connection with the development of high early strength cement would do the industry genuine good in leading toward the production of a better cement, even if high early strength cements themselves were not the goal. We believe, on the basis of these returns, that few cement chemists believe present high early strength cements are the whole or final answer to the problem of meeting ultimate demand. High early strength is desirable, apparently, but not at the expense of more enduring qualities.

We find 43 of the 50 cement chemists place the improvement of the standard product, or the making of a better all-round cement as a primary objective of their research. Seven were noncommittal. The only comments on this phase of their work were these:

"Our cement had 75% better concrete-making properties in 1927 over 1926."

* * * *

"Principally to make a more uniform cement."

* * * *

"Almost continuously working to make a better all-round cement."

* * * *

To Obtain More Accurate Control of Manufacture

Of the 50 company chemists, 38 are doing research work aimed to give a more accurate control of the manufacturing process. Two had no research work of this type under way, and nine were noncommittal. Typical comments were:

"Continuous consideration."

* * * *

"Considerable."

* * * *

"In addition to other things of interest."

* * * *

"Always."

* * * *

"Particularly control of SO_3 and raw blending."

* * * *

"This and research on the constitution of cement are too involved, and require a study of the complete heat treatment."

* * * *

Accurate control of manufacture begins at the quarry, and we doubt if many cement chemists have adequate authority over quarry operation to fully utilize their knowledge of the raw materials. We believe it is possible also for cement manufacturers to make much fuller use of automatic recording and control instruments, which in other industries are an immense help to the chemists' control of processing. Even such simple devices as automatic continuous samplers, like those described in Rock Products, November 24, 1928, which are standard equipment in many metallurgical operations, are practically unknown in the cement industry.

Constitution of Portland Cement

Independent company research on the constitution of portland cement is in progress by 16 of the companies reporting; 14 reported no research work of this character, and the others were noncommittal. Some comments on research on the constitution of cement follow:

"Not equipped for."

* * * *

"By studying the investigations made by Dr. Bogue at the Bureau of Standards."

* * * *

"Through the Bureau of Standards work only."

* * * *

"No, we are leaving that to Dr. Bogue and co-workers at Washington."

* * * *

"Several attempts."

* * * *

Research on Admixtures

We were rather surprised at the extent of research on the effect of admixtures on portland cement. Such admixtures include pozzolanas, calcium chloride, etc. Of the 50 reporting companies, 36 are doing research on such admixtures; 8 are not and 6 are noncommittal. Comments on research in connection with admixtures were:

"Have done and are continuing to do considerable work along this line."

* * * *

"Yes—with pozzolanas."

* * * *

"Not to any extent."

* * * *

"Have two investigations of such nature under way now."

* * * *

"No work on cement alloys."

* * * *

"Have done considerable work on use of calcium chloride."

* * * *

"Especially calcium chloride and similar substances."

* * * *

"We have covered the field of admixtures in all our yearly programs, but are about through."

"We made a study of pozzolana admixtures several years ago."

* * * *

"Work has been done with these admixtures."

* * * *

"Yes—calcium chloride."

* * * *

"Have worked on these in past years."

* * * *

To Apply Association's Research Results

The Portland Cement Association's research work must by this time have furnished many clues for local plant research. Of the 50 reporting company chemists, 25 are doing research work to apply the findings of the Bureau of Standards; 9 are not; 16 are non-committal. Some of the comments were:

"Wherever possible."

* * * *

"To a limited extent."

* * * *

"Working independently."

* * * *

"With respect to SO_3 and free lime."

* * * *

"No, they are not yet in a formative stage."

* * * *

To Study the Uses of Cement

It always seemed to us that one phase of research work that could be done practically entirely by the association is on the uses of cement. We do not see why cement plant chemists should find it necessary to spend much time studying or investigating the uses of cement. There may be special instances of special products where out-of-the-ordinary uses may be investigated and developed, but we fail to see the need of any great amount of research on the use of cement generally. Yet 29 cement chemists reported research work to study the uses of cement; 8 reported none, and 13 were noncommittal. A few comments were:

"Very much."

* * * *

"Always trying to find new uses for cement."

* * * *

"One man nearly full time."

* * * *

"Some time devoted along this line."

* * * *

"This is constantly involved."

* * * *

Special Lines of Research

Nineteen of the 50 companies are engaged in some special line of research; 9 are not; 22 are noncommittal. Some clues as to what these special researches are may be gained from the following comments:

"We are endeavoring to study all problems as they come up, incidental to the manufacture and application of portland cement."

"We desire to see concrete that will stand the ravages of time rather than freakish early strengths."

* * * *

"We do research on problems peculiar to our own process of using and handling certain byproducts."

* * * *

"We are doing special research along several lines, endlessly."

* * * *

"Yes, principally on the utilization of certain raw materials."

* * * *

"A manufacturing method to reduce the cost of production of ordinary portland cement."

* * * *

"Fundamental work on fine grinding."

* * * *

"Control of cement from the consumers' viewpoint as needed, such as mix design."

* * * *

"We think most member companies of the Portland Cement Association expect the association to do their research work for them. That is one purpose of the association."

* * * *

"As needed to overcome difficulties of operation or unsatisfactory concrete, if the cause of failure is not obvious."

* * * *

"Some special problems have been, are and will be investigated."

* * * *

"Still studying the possibilities for early strength in either special cement, or a general improvement of the standard product. Especially investigation of the effects of small quantities of other elements. Also reason for and means for preventing warehouse set."

* * * *

"Occasionally we do some work requested by the association."

* * * *

"To make the best that can be made to meet all demands."

* * * *

"At present working on relations of fineness of grinding of raw materials, degree of hardness in clinker burning, and fineness of grinding clinker, as these factors affect the tensile strength of cement."

* * * *

"Have been trying to make a cement that will resist the action of sea water and alkali soils."

* * * *

"More of a service department for consumers."

* * * *

"Developing a brick mortar cement to utilize a waste product accumulated over several years' operation."

* * * *

"A number of related problems appear from time to time as all research develops."

Chemical or Physical Testing Most Important?

In spite of the fact that many outsiders contend that the manufacture of portland cement is mainly a chemical industry only two cement plant chemists place the most emphasis on chemical analyses. Ten place the most emphasis on physical tests and 34 place equal emphasis on chemical analyses and physical tests. The others are noncommittal. Physical tests of cement are in the nature of a post-mortem on cement already made. They are essential as checks, but it seems to us that the future progress of the industry is in chemical analyses and chemical control that will make physical tests of the finished product of secondary importance. Some comments on this phase of research work follow:

"About 50-50."

* * * *

"Chemical analysis and physical tests must be studied for a true interpretation of the value of cement—they are complimentary tests."

* * * *

"Chemical combined with physical tests."

* * * *

"Co-ordinated."

* * * *

"Make complete physical tests, including concrete."

* * * *

"Concrete tests co-ordinated with chemical analyses."

* * * *

"No emphasis on physical tests—this is taken care of by the control."

* * * *

"Study the effects of variations in both chemical analyses and physical tests,"

* * * *

"Physical tests are the criterion, but chemical analyses are essential at every step of the investigation."

* * * *

"About equally stressed."

* * * *

"Yes, the ability of the cement to make satisfactory and durable concrete is the prime essential of our business."

* * * *

"The two are combined."

* * * *

"The most emphasis on physical tests. Chemical analyses are helpful only as checks on manufacture."

* * * *

"Equal emphasis."

* * * *

"Special emphasis on compression and transverse tests."

* * * *

"Operation and chemical analyses must go hand in hand."

* * * *

"Both are necessary."

Microscopic and X-Ray Analyses

Cement manufacture and metallurgy both are probably largely dependent on applied knowledge of crystallography. Not much progress was made in metallurgy as long as sole reliance was placed on chemical and physical methods of investigation or testing. A world of new facts was established through systematic and industrious use of the microscope and more recently of x-ray microscopic study. Yet only 12 of the 50 cement chemists use microscopes in their research work; 21 state positively they do not; 17 are noncommittal. Some typical comments on the use of the microscope in cement research follow:

"Very little."

* * * *

"For analyses."

* * * *

"No equipment."

* * * *

"None at present."

* * * *

"Use microscope to a limited extent for determinations of free lime, etc., and to study the mineral composition of raw materials."

* * * *

"Not yet attempted."

* * * *

"Microscopic examinations are employed."

* * * *

"Microscopic examinations only, not analyses."

* * * *

"In research work only."

* * * *

"Occasionally, as the situation demands."

* * * *

"Not as yet."

* * * *

"Attempted, but poor results."

* * * *

"Some time devoted to microscopic examination."

* * * *

"None so far."

* * * *

"Yes, for free lime and crystal size in clinker."

* * * *

"Yes, co-ordinating this method with chemical analyses and physical tests."

* * * *

Not one cement plant laboratory is yet equipped with apparatus for x-ray study of raw materials or clinker, although this method is being employed at the Bureau of Standards. It is true, of course, that x-ray analyses are not of much value until an exhaustive study has been made and certain fundamental key photomicrographs catalogued and indexed. Several agencies are now engaged in such work and eventually all kinds of minerals may be accurately analyzed by this method. Nevertheless, we can see no reason why a cement chemist should not be able to learn many helpful things

about his raw materials and his product by making independent x-ray studies of it. The chances are that he would also be in a position to make some valuable original contributions to knowledge about cement.

That some cement plant laboratories are considering the installation of x-ray apparatus is indicated by the following comments:

"None at present."

* * * *

"Not yet attempted."

* * * *

"No, we are not equipped for this; others are providing us with this information as developed."

* * * *

"None so far."

* * * *

"Not equipped at present."

* * * *

Most Important Research Problems

Last of all we come to the most interesting phase of our whole study. What, in the opinion of cement chemists themselves, are the most important problems of the industry? We have had this discussed by about everyone except the chemists; let's see what they have to say:

"To determine workability and then develop those physical and chemical properties which will produce plasticity and strength in the same cement; or make a cement so plastic that it will allow low water-cement ratios in all kinds of construction."

* * * *

"Increase the thermal efficiency of rotary kilns; decrease ring formation in kilns."

* * * *

"Study of clinker from modern kilns under the microscope, combined with the chemical analyses, with different degrees of fineness, with different chemical combinations of the raw materials. Effects of rapid hydration, catalizers; and effects with age upon concrete."

* * * *

"Uniform testing among different laboratories. Non-crazing concrete. The constitution of portland cement clinker, so that different authorities of different countries may at least partially agree."

* * * *

"If high early strength cement should prove to be as dependable, and serve without deterioration, as standard portland cement, why should cement users wait longer than necessary for curing, if it can be avoided? Dependability of early strength cements may revolutionize the cement industry (or at least emphasize the good qualities of existing cements, if early strength cements fail)."

* * * *

"Strength, permanency and chemical resistance."

* * * *

"Physical test that will classify cement. A cement that is not so sensitive to variations found in field use. Study of coal consumption and coal-burning devices. Economies of fine grinding, raw and finish, in connection with better cement."

* * * *

"Accurate control of manufacture coupled with all the knowledge obtained from all lines of research."

* * * *

"It seems that a more thorough knowledge of the true composition of cement clinker, and the reactions in burning clinker, would be one of the most important problems at the present time. Much has been learned, but much more remains to be learned."

* * * *

"To develop a high early strength cement that continues to gain in strength with age. To determine what influence the presence of free lime, the alkalis and sulphides have on the initial and ultimate strengths of cement. To develop portland cement to such an extent that high-alumina and other special cements will have no advantages over the former in any respect or for any purpose."

* * * *

"The determination and development of those factors which make for permanence of concrete, especially the study of resistance to external deteriorating agents, and the study of the effect on concrete of small amounts of compounds not normally present."

* * * *

"The actual chemical composition of portland cement clinker and its relation to physical tests on the finished product."

* * * *

"Study of volume changes during setting. Study of fluxes to increase tricalcium silicate content. Some routine method of determining tricalcium silicate content."

* * * *

"How to produce more durable concrete. To determine by long-time tests if accelerated cements will withstand the various disintegrating agencies as well as present normal portland cements."

* * * *

"Proper preparation of raw mixture; that is, particle sizing."

* * * *

"Balancing fine grinding against chemical composition for more economical production of high quality cement, in conjunction with the study of the principles of grinding."

* * * *

"I employ two chemists for chemical and physical research. At a slight increase in cost of manufacture we are able to produce a high early strength cement, which we are able to put on the market when there is a demand for it."

* * * *

"This being a new mill, perhaps it has an advantage over the older ones, for making rapid-hardening, high early strength cement, for we are actually making it, placing it in bags, and letting our customers and their testing laboratories verify our claims."

"Quicker hardening cements and cements producing better concrete."

* * * *

"Reduce cost of production by increasing the thermal efficiency of clinker burning."

* * * *

"The ascertaining of the optimum size particle for both raw and finish, and then producing the maximum quantity of those sizes at the lowest cost. Also a complete study of the cooling of clinker, as there can be found no tie-up as yet with chemical analysis, constitutional formulae and physical properties, indicating our data are lacking in the important problem of fixing the reaction after the burning is complete."

"The nature of setting and hardening processes of portland cement."

* * * *

"To study the economy of the use of fuel."

* * * *

"Strength control of concrete. Admixtures."

* * * *

"Development of an inexpensive means of greatly lowering the clinkering temperature of high-limed cement clinker. Discovery of an accelerator for developing high early strengths in ordinary portland cement without extremely fine grinding the clinker."

* * * *

"High early strength and more elasticity or freedom from cracking or checking. To this might be added waterproofing. No other product is so much abused and misused as portland cement. To make it foolproof would help a lot."

* * * *

"The effect of impurities, content of relatively insignificant amounts of certain constituents in cement, such for example as phosphates, alkalis, manganese, titanium. Important, too, are the various researches in concrete, including effect of excess water, poor, unsound aggregate, etc. In parts of this country tannic acid and allied organic impurities cause lots of trouble. One of our pastimes is the search for an economical way of neutralizing the effect of impurities in otherwise good aggregates, in order to save the customer the expense of long hauls for isolated structures, and where washing the aggregates is impracticable."

* * * *

"Determination, positively, of the exact compounds present in cement clinkers. Determination, positively, of the chemistry and mechanics of the hydration of cement. Improvement of cement for greater strength, lower coefficient of expansion, and resistance to deterioration in concrete."

* * * *

"High early strength. Constitution and properties of the different constituents. Like most plants, we are unable to undertake any of the major researches because of lack of facilities."

* * * *

"More definite knowledge and control of all factors exerting an influence on burning

in the rotary kiln. Further conservation by elimination of preventable losses in drying, burning and cooling processes."

* * * *

"To reduce coal consumption. To produce a cement better resistant to magnesium salts and soluble sulphates."

* * * *

"High early strength cement. Better portland cement for long-time tests. To help the consumer in the uses of cement. Develop cements either with or without admixtures for cold weather concreting. Thorough study of the different aggregates used in concrete construction."

* * * *

"The problems being studied by the Portland Cement Association at the Bureau of Standards. Also research to discover methods to make a portland cement that complies with A. S. T. M. specifications more plastic and workable without admixtures."

* * * *

"High early strength cements. Increasing the strength of concrete by study of aggregates."

* * * *

"Problem of utilization of inert (?) material in finished cement to make a higher quality product."

* * * *

"Combustion efficiency and better refractories. More utilization of waste heat."

* * * *

"Mill control problems. Economic problems of production. Constitution of cement. Methods of measuring physical properties of cement and concrete."

* * * *

"Combustion and grinding."

* * * *

"To make a cement that will give good results in a short time, but one that will not lose in quality in storage for a reasonable period."

* * * *

"To determine the exact composition and combination of the major constituents contained in portland cement, and a more and better understanding of the action of gypsum and other retarders."

* * * *

"Apparently the present goal is to obtain high early strength, with the curve up to 28 days and beyond to 6 months showing progression and no retrogression. To control the mix as near to the point of getting intimate fusion as possible in burning. To give the kilns the least work to do by obtaining a homogeneous fineness in the raw end."

* * * *

"To develop a cement which will attain maximum strength in short periods."

* * * *

"Fine grinding raw material and fine grinding finished cement economically."

* * * *

"The development of a portland cement that will attain its maximum strength within a few hours without retrogression at later ages. The constitution of cement clinker. The development of practicable routine methods for constitutional determinations for control during manufacture. Improved methods for physical tests."

* * * *

"The development of high early strength cement. The day for high early strength portland cement has arrived. Its coming was inevitable. Roughly, 90% of the cement manufactured in this country is not high early strength, and about 50% just squeezes past the standard specifications. Those who succeed in this development will carry on; those who do not will fall by the wayside."

* * * *

Conclusions

In conclusion we thoroughly agree with one of our correspondents who has also been a welcome contributor to Rock Products during the past year, and of whose ability as a chemist and a thoroughly scientific man in every respect, we have the highest regard. He writes:

"I think the criticism by men outside of the cement industry of the chemists of this industry concerning their qualifications and ability is highly unjust and without foundation. True, the cement industry has advanced very slowly, but nevertheless surely. Portland cement cannot be manufactured in a test tube. It requires the highest degree of combined chemical and mechanical skill in its intricate process of manufacture. I state with confidence that the manufacture of cement, in my opinion, is one of the foremost, truly chemical engineering processes, and its development is due not to one but to the thousands of loyal and able chemists and engineers who have combated one of chemical engineering's most difficult problems."

One difficulty, we believe, has been that plant chemists have long labored in isolated places with little facility for exchanging their views, their findings and their experiences. During the past year Rock Products has published several contributions from cement plant chemists, which in the opinion of those most competent to judge have been real and valuable contributions to technical literature. We have more such contributions to publish the early part of next year. We will welcome still more. It is time for cement plant chemists to assert themselves in literature. They have seldom been encouraged to do so in the past.

Grinding Pebbles and Tube Mill Lining

THE PRODUCTION for 1927 of grinding pebbles together with the output of cut quartzite blocks for tube mill lining was 3342 short tons valued at $46,856. This year's production will probably be less than the above tonnage.

The advent of alloy steel liners and grinding medias has no doubt been the reason for this old industry slumping from 12,469 tons valued at $129,485 in 1918 to the above figures in 1927. The pebble production was from California and the cut quartzite from South Dakota and Minnesota.

A New Patented Process in Connection with Portland Cement Manufacture

By W. P. ECKDAHL

SLURRY made from blast furnace slag and limestone has a tendency to set, due to hydration. This delays or prevents removal of the material from tanks, causes clogging of pipe lines, and is troublesome in many ways. A number of remedies have been suggested—such as the addition of small quantities of dextrin, dilution with water, and cooling.

In the newly invented process, kiln gases are passed into the slurry. The carbon dioxide present produces carbonates which diminish or destroy entirely the hydraulic properties of the slag.

The process has a number of advantages. The only operating cost involved is the power required for handling the gases. The installation may be so arranged that this power aids in providing the kiln with draft and in agitating the slurry. The solid particles in the slurry become more granular, which greatly facilitates filtering, when it is desired to remove some of the water in this way before sending the material to the kiln.

Graphite

THE PRODUCTION of graphite is confined to two classes of materials, amorphous acid and crystalline. The production and value of these products are given for the last five years.

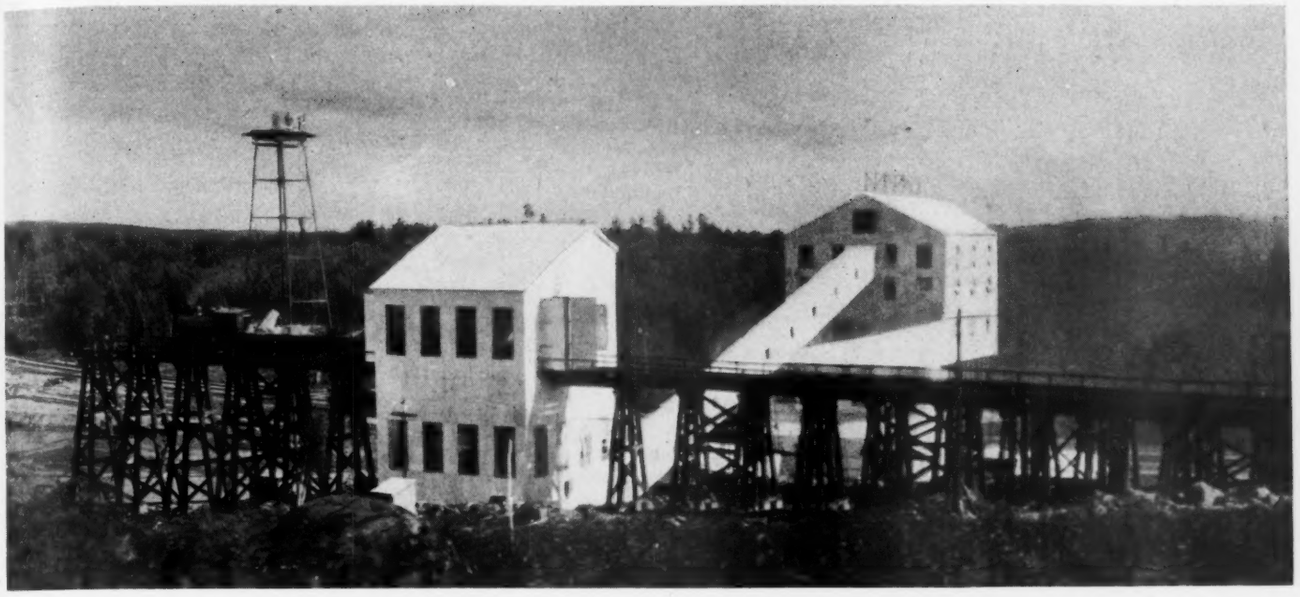
AMORPHOUS

Year	Short tons	Value	Value per ton
1924	4,071	$38,533	$ 9.45
1925	3,536	39,640	11.20
1926	2,975	40,500	13.60
1927	2,595	35,850	13.75
1928	.....	.....	.....

CRYSTALLINE

Year	Short tons	Value	Value per ton
1924	900	$48,977	$54.40
1925	1,129	56,721	50.25
1926	2,495	178,842	71.50
1927	2,612	197,121	75.80
1928	.....	.....	.....

The old method of concentrating graphitic ores was by a complicated and crude washing process, separation being effected by the difference in specific gravity of the graphite and the gangue. Researches by the Southwestern Engineering Corp. of Los Angeles, Calif., resulted in that company designing and erecting a concentration plant at Burnet, Tex., using the oil flotation process as a means of separating the graphite from the waste. This plant was described in the September 1 issue of Rock Products.



Canada's newest crushed stone plant at Hawk Lake, Ontario

Crushed Stone Industry in 1928

Production of Crushed Stone Continues to Climb, with Prices Slightly Lower During 1928

PRODUCTION of crushed stone in 1928 apparently increased 4%, but the average price received was apparently 3% lower during 1928 than for the preceding year. The production during 1927, according to the latest statistics compiled by the United States Department of Commerce, was 94,948,770 tons valued at $97,474,267, or $1.02 per ton. Using these figures as a base for computation, there was an increase for 1928 of 3,797,000 tons, making a total of 98,745,770 tons, and a value of $97,758,000, or approximately the same as in 1927. The complete production tonnage and value for 1927 were published in ROCK PRODUCTS, November 24.

According to accepted figures, the total value of all building construction during 1928 was $8,000,000,000, of which 1.18% went for crushed stone. The comparative figure for 1926 was 1.12% and for 1927, 1.22%. This figure excludes the value of crushed rock for ballast or for any purposes that can be defined as not belonging to a true construction classification. A computation could not be made earlier than 1926, as the Department of Commerce method of segregating crushed stone was not started until 1926.

Crushed-stone production in the Pacific Coast territories, especially in California, showed the largest reduction, and the largest percentage of reduction in prices as well. Crushed-stone producers in California, especially in the southern portion, have severe competition with sand and gravel operators. Indiana apparently was a close second as to reductions in both tonnage and price, but for the states which are of the greatest industrial importance, the tonnage and value of crushed stone produced appear to have been nearer 1927 levels.

From the number of plants that reported an increase in producing capacity during 1928 and the percentage of that increase, it would appear that plant capacities increased 20%, when those plants are left out of consideration that stopped operations, burned or ceased to exist for any reason during that time. Thirteen quarry operators reported "out of business" during the past year. There were 73 incorporations with a total capitalization of about $6,000,000. For 1927 there were 76 incorporations with capital values of $8,147,000.

Some 16% of the quarry operators reported that they expected to increase their capacity during 1929, the range of increase being from 10% to 200%, with the average amount of increase 30%, but as these operators were, for the most part, small tonnage producers, the effect on the tonnage for 1929 will be relatively small. It is significant that among the exceedingly large number of questionnaires returned that only two operators reported that they expected to show a larger business by a more systematically planned sales campaign.

The use of trucks in quarry operations and for shipping purposes seems to be gaining favor. The statistics show that 44% of the deliveries were by truck, although this does not mean 44% of the tonnage. Shipments by water from quarries to central distributing points located in the industrial sections gained favor, probably due to the increasing use of self-unloading cargo boats.

For comparative purposes the tonnage and value of crushed stone for 1926 and 1927 is shown on the following page.

Other interesting information, from our own sources, as to the kind of rock crushed is given in the following table. This tabulation is not to be inferred as having any direct relation to the tonnage, but only to the number of plants in each classification:

	Per cent
Limestone	55.0
Trap	10.3
Dolomite	10.1
Granite	8.3
Gravel	4.2
Travertine-marble	2.4
Sandstone, quartzite, ganister, gneiss, etc.	9.7
	100.0

Highway construction still leads as a consumer of crushed stone, with general building second. Crushed trap rock for railroad ballast also steadily gained, especially in Canada. The production increase of ballast in Canada alone for 1928 will probably be upwards of 1,400,000 tons, due to the Canadian Pacific Railway's policy of resurfacing its tracks with granite and trap rock ballast. This increase is notable when it is considered that in 1926 the entire production of rock for railroad ballast in Canada was only

Uses*	1926 Short tons	1926 Value	1927 Short tons	1927 Value
Crushed stone	82,515,560	$87,872,014	94,948,770	$97,474,267
Building stone	2,609,190	39,922,851	2,485,120	40,595,127
Monumental stone	359,950	14,580,929	358,130	14,993,091
Paving blocks	366,370	3,399,602	366,740	3,583,400
Curbing	346,020	4,303,280	378,230	4,939,716
Flagging	66,330	657,435	55,160	573,736
Rubble	539,670	917,433	809,020	988,108
Rip rap	4,060,280	4,652,717	4,618,500	4,716,731
Flux stone	23,859,390	18,049,012	21,660,070	15,985,525
Refractory stone	1,531,070	1,925,832	1,362,920	1,710,708
Agstone	1,850,620	3,064,235	2,206,470	3,360,704
Manufacturing industries	4,953,800	4,376,026	5,352,130	4,735,114
Other uses	1,438,110	4,587,224	1,738,000	4,995,395
Total (approximate, in short tons)	124,496,360	$188,308,590	136,345,260	$198,661,622

*Although the upper half of the uses listed above are not strictly crushed stone, the plants producing this material (building, monumental, curbing, etc., stone) can generally be classed as crushed stone producers, since many of them crush waste rock to sell as a byproduct. This is especially true of marble, granite and limestone.

2,222,500 tons.

There seems to be a continued demand for a better grade of product, both as to size of material and quality and cleanliness. Many companies reported changing from dry plants to washing plants, and the number replacing rotary screens with vibratory screens was exceptionally noteworthy.

In safety work the White Haven operation of the General Crushed Stone Co. was

Safety magazine at the White Haven plant

awarded the first trophy of *The Explosives Engineer* for having the best no-accident record in 1927 of any member of the National Crushed Stone Association. The figures compiled by the United States Bureau of Mines show that three of the plants of the General Crushed Stone Co. went through 1927 without a lost-time accident, and the award was made to the White Haven plant, because it had the largest man-hour exposure record.

New Plants

Perhaps the largest and most noteworthy crushed-stone plant built during 1928 was that of the Standard Trap Rock Co., of New York City, at Piermont, N. Y. This plant was described in the November 24 issue of Rock Products, and aside from many unusual mechanical features it is of interest because it may never operate. The Palisades Interstate Park Commission interceded and ruled that the operation of this plant's quarry would deface the scenery along the Hudson River Palisades. The design of the plant represented the composite knowledge and experience of three outstanding authorities on crushing plant design, construction and operation—James G. Shaw, vice-president of the Standard Trap Rock Co., for many years the operating head of the New York Trap Rock Corp.; the engineering staff of the Allis-Chalmers Manufacturing Co., at New York City, which supplied the major equipment, and the Burrell Engineering and Construction Co., Chicago, builders of several notable new stone and cement plants.

Not all of the new crushing plants in the metropolitan area of New York are of extremely large size, as one installation, that of the Lukenbach Quarry Co., built in New Jersey, just across the river from New York City, was designed for a capacity of 700 tons of trap rock per 10-hour day. The plant was designed by the engineering staff of Earle C. Bacon, Inc., New York City, and is equipped with two jaw crushers, a 42x36-in. and a 36x15-in. The trap rock is crushed to 3½ in. in the primary breaker, scalped, and the oversize from this screen sent to the smaller crusher which is set to deliver a 1-in. product.

A third notable new plant was that of the Illinois Electric Limestone Co., described in the September 15 issue of Rock Products. This plant, like the Standard Trap Rock Co. plant, uses belt conveyors for both elevating and conveying for all the operations, with one exception, and accentuates the trend toward use of belt conveyors in place of bucket elevators.

A new ballast plant for the Grenville Crushed Stone Co., at Hawk Lake, Ont., Canada, was built to supply crushed granite for ballast for the Canadian Pacific Railway. This plant will be capable of producing 5000 cu. yd. of ballast per day. A modern plant of this size, located in the wilds of western Ontario, is a result of the Canadian Pacific Railway's decision to use crushed stone for resurfacing of its entire roadbed. This plant also is a 100% belt conveyor operation. All of the various units in the plant are direct-motor driven through geared reduction units. Electric power is supplied the motors by the company's own Diesel-engine generator sets, which are located in one end of the machine shop. The plant started operations during September, 1928, just in the nature of a prelinminary try-out, as the operating season was then over.

During 1928 the Sturgeon Bay Co., Sturgeon Bay, Wis. (a subsidiary of Dolomite, Inc.), completed alterations to its crushing plant, which were of such a nature that the plant can be classed under new construction. The plant can be taken as a classic example to show the trend in crushed-stone plant design and operation: (1) Electrification of the quarry operation; (2) belt conveyor-elevators; (3) surge bins between different units; (4) vibrating sizing screens; (5) washing of stone; (6) water transportation by use of self-unloading boats. The company expects to make extended changes in the washing and screening plant, as well as in the boat loading equipment during 1929.

The South Carolina Granite Co., Blair, S. C., and the Wm. P. McDonald Co., Atlanta, Ga., built new plants, both using 60- by 48-in. Allis-Chalmers jaw crushers as primary breakers. The Solvay Process Co., Syracuse, N. Y., is using a 60-in. gyratory, and the Hawk Lake operation previously referred to is using a 42-in. Allis-Chalmers gyratory for primary crushing.

The Bethlehem Mines Corp. built a new

The employes of the White Haven, Penn., plant of the General Crushed Stone Co. receive safety trophy for their year's work

flux and commercial stone plant in Pennsylvania with a 48x60-in. Traylor jaw crusher as a primary breaker.

The new plant of the Campbell Sons Co., Towson, Md., is one of several plants using Diesel, or semi-Diesel, engines for power production. It might be added here that there were several old plants repowered with Diesel engines, which in most cases are directly connected to generator sets, and from figures quoted there is evidently a considerable saving when producers in isolated locations develop their own electricity. One instance is cited where a stone producer developed his own power at 0.9c. per k.w.h. Another operated his plant, which had a capacity of 600 cu. yd. per day, at a total power cost, exclusive of labor, of $11 per day. Moreover, these two plants were both located in the heart of industrial sections and electrical power was readily available from public utilities.

The plant of the Dominion Trap Rock Co., Bruce Mines, Ont., was another plant that underwent alterations and changes of such size as to better be classed as a new plant. This company took over the plant formerly known as the Bruce Mines Trap Rock Co. and made changes and alterations in the quarry and plant and will ship via self-unloading boats to Cleveland, Ohio, and other lake ports.

The Quinn Stone and Ore Co., Ft. Williams, Ont., is another Canadian trap rock producer shipping to United States ports on the Great Lakes and supplying the Canadian Pacific Railway with ballast as well. This plant washes all its stone, using a Dorr classifier in conjunction with water sprays on the vibrating screens for this purpose.

The new plant of the Lukenbach Quarry Co. near New York City

Distribution Depots

Increasing numbers of crushed-stone operators have come to realize the value of shipping in cars, barges or self-unloading boats from point of production to centrally located distribution yards, where the various products can be conveniently stored, cheaply reclaimed and hauled to the various jobs by truck. The installation of batcher bins of various capacities is one phase of this trend; other producers have installed more substantial redistributing yards, noteworthy among which was the Brownell Improvement Co.'s new yard built to serve the Chicago area.

An interesting example of the value of steel service bins for crushed stone is found in a recent installation at Worcester, Mass. This plant was erected three or four years ago for a specific consumer. Recently the company decided to locate the plant in another part of the city. The units were dismantled and removed to the new location and re-erected without loss of material—a full 100% salvage.

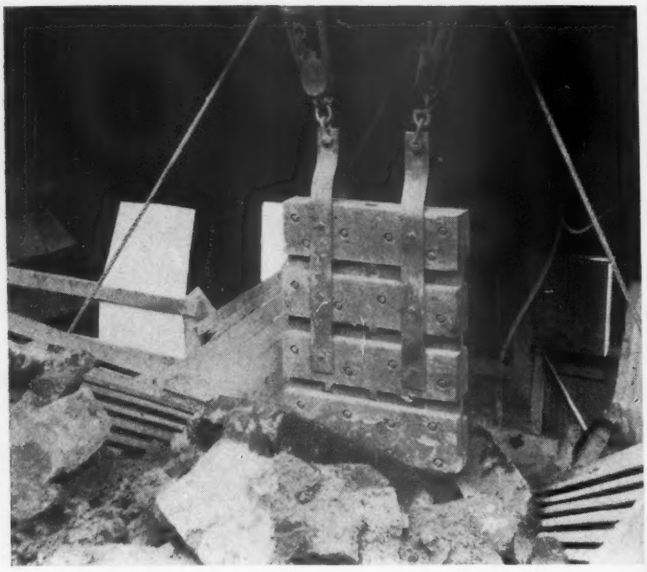
Standard Trap Rock Corp.'s new plant at Piermont, N. Y., nearly complete

Powder, Power and Labor Costs

In the March 31 issue of Rock Products was a short description of a new plant operating in England. The plant description gave some interesting figures, among which was the production of stone per pound of explosive. At that plant 7.15 tons of rock was secured per pound of explosive, a figure which speaks for itself. On the other hand, the investment of $500,000 for plant alone for a daily capacity of 1430 tons for two shifts, of 715 tons for one shift, gives the figure of $700 of investment per ton of stone per day on the single-shift basis.

On four new plants in the United States similar comparative figures show $112, $266, $200 and $333.33 to have been invested in plants to produce one ton of crushed stone per day. A detailed analysis might show why, but it is not the purpose of this review to do so, but only to show the achievements of American producers as compared to this English plant. This English plant also shows a smaller number of tons produced per horsepower per day of any new plant built in this country during the year. Compilations show that the English plant produces about 1.34 tons in one day with one horsepower, while the newer plants in the States produced 2.90, 4.32, 6.29, 2.28, 2.72 and 2.53 tons per horsepower per day. Analysis of two of the older plants in the United States, however, showed a power consumption of 1 and 1.8 hp. per ton per day.

The number of men employed at the English plant was not given, so a comparison could not be made between the English practice and American, but a survey of new American plants shows the tons per man per day to run as follows: 35.7, 66, 30 and 21.9, for the four plants on which figures were



Swing bumper in the plant of the Lukenbach Quarry Co.

Plant of Campbell Sons Co., Towson, Md., built during 1928

available at the time this was written.

Explosives and Blasting Practice

At a New York Crushed Stone Association meeting some interesting data were presented regarding the use of liquid oxygen as an explosive, and instances were cited showing costs of this explosive compared to others.

George B. Holder, mining engineer, of the Air Reduction Co., New York City, told of the experience of the Michigan Limestone and Chemical Co., Calcite, Mich., the largest quarry operator in the world, with the liquid oxygen explosive. In substance he said liquid oxygen explosive, at a cost of 7c. per pound, is producing 12 tons of rock broken per pound of explosive. This plant is now supplying 25% of the explosive used on this operation.

The following summary of quarry operations was compiled by Rock Products' research department during the year, incidental to making a directory of the commercial crushed-stone industry:

Methods of Quarrying

Method used	Number of companies	% of total
Well drills only	49	14.8
Hammer type only	142	43.0
Both types used	139	42.2
	330	*100.0

*Percentage of the total (330) is given instead of the total number of companies, since some did not give drills used.

Types of Crushers Used

Numbers of crushers are actual count, and the percentages are of total count.

Type of crusher	Number	% of total
Gyratory	506	51.2
Jaw	244	24.7
Rolls	108	10.9
Hammermill	75	7.6
Cone	29	2.9
Disc	22	2.2
Ring-roll, rotary, etc.	5	0.5
	989	100.0

Methods of Shipping Product

By number of mentions. Some companies do not mention any and others give more than one.

Method of shipping	Number	% of total
Rail	296	51.0
Truck	256	44.0
Water	19	3.2
Ready-mixed concrete	5	0.8
Trolley and other	6	1.0
	582	100.0

Delivery to Crusher

By companies mentioning method of delivery. Some did not give any method, and others gave more than one.

Method used	Number	% of total
Cars and hoist	121	25.5
Locomotives and cars	115	24.2
Trucks	70	14.7
Cars, tram and other	68	14.3
Conveyors	51	10.7
Cableways or skips	23	4.8
Carts, tractors, etc.	27	5.8
	475	100.0

Companies selling washed material, 53 or 10.7%.

Companies with a stripping problem, 290, or 58.3%.

Partial view of crushing plant of the Sturgeon Bay Co.

Companies reporting improvements or changes during 1928, 113, or 22.8%.
Companies reporting decreased production, 6, or 1.2%.
New plants reported during 1928, by established producers, 7.

Quarry Company Incorporations Recorded in Rock Products During 1928

	Number of Incorporations	Total Capitalization
Arkansas*	2	$ 50,000
California	4	1,540,000
Connecticut	1	100,000
Delaware	4	410,000
Florida*	3	35,000
Georgia*	4	80,000
Illinois*	5	335,000
Indiana*	2	50,000
Kansas*	1	.....
Kentucky	1	20,000
Maine	1	100,000
Maryland*	1	.....
Massachusetts*	7	195,000
Mississippi	1	375,000
Missouri*	7	35,000
Montana	1	50,000
New Jersey*	1	.....
New York	5	903,000
North Carolina	3	300,000
Ohio*	3	.....
Oklahoma	1	5,000
Oregon	1	100,000
Pennsylvania	2	40,000
Rhode Island*	1	.....
South Carolina*	2	500,000
Tennessee*	4	125,000
Texas	3	335,000
Virginia	2	75,000
Total for 1928	73	$5,758,000
Total for 1927	76	8,147,000
Canada* 1928	10	1,439,000

*Indicates incorporations in which stock is listed as of no par value.

Taking into account the "no par" capitalization, the total was probably not less than $6,000,000 for the year 1928.

Crushed Slag in 1928

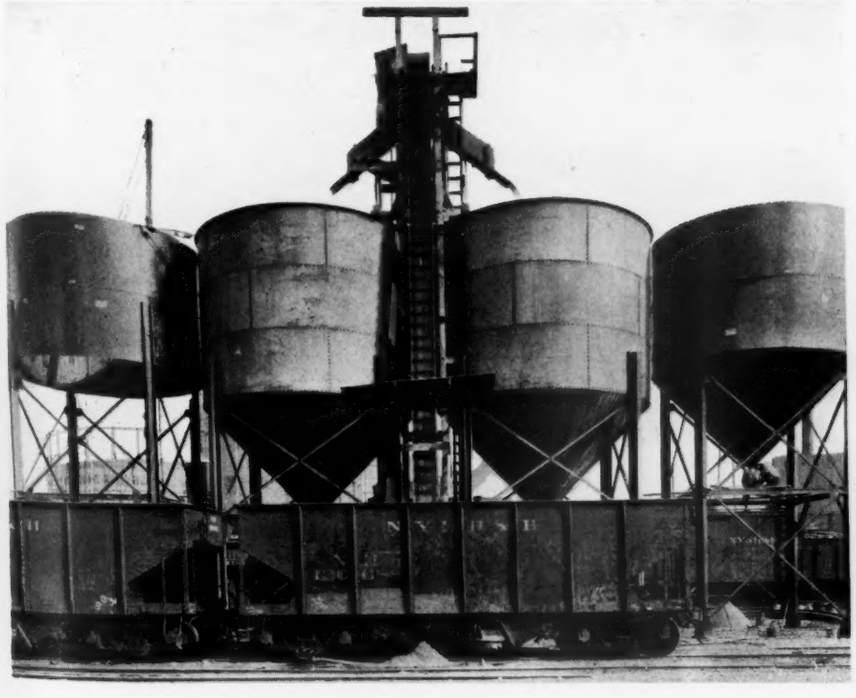
THERE was a constant demand during 1928 for cleaner materials for concrete aggregate in all the rock products industries, and the crushed slag industry was no exception. Crushed slag is graded in several sizes and the specifications for railroad ballast, macadam highway construction and especially concrete became more exacting.

The National Slag Association, with headquarters at 937 Leader Bldg., Cleveland, Ohio, has from time to time issued a series of bulletins on blast furnace slags. To date there have been nine of these bulletins issued, the last one appearing in October, 1928, and covering the use of slag ballast for railways. Previous symposiums were as follows: (1) "Absorption of Slag and Slag Concrete"; (2) "Resistance of Blast Furnace Slag to Abrasion and Wear"; (3) "Action of Slag Under High Temperatures and Fire"; (4) "Manufacture and Use of Slag Products"; (5) "Bond in Slag and Slag Concrete"; (6) "Preparation of Slag for Market"; (7) "Use of Slag in Concrete Roads and Pavements," and (8) "Use of Slag in Bituminous Construction."

Judging from the reports received, crushed slag production for the year dropped about 15%, with prices practically the same as for 1927. The tonnage produced probably was close to 9,000,000 tons, of which 43% was for highway material, 28% for concrete aggregate, 26% for ballast, 1% for roofing material and 5% classed as specialties. Apparently 85% of the slag was shipped by rail and 15% by truck.

The France Slag Co., of Toledo, Ohio, completed a modern crushing plant at East Toledo, replacing the plant destroyed by fire late in 1927. The plant is of steel and concrete construction and has many unusual features, among which are: the hoisting of standard railroad hopper cars; scalping of raw material ahead of crusher by means of disc grizzly; the use of a 72-in. by 30-ft. all-steel revolving screen; the use of a 60-in. by 24-ft. revolving screen specially designed and built by the France company; a special loading and rescreening installation for removal of undersize and spalls prior to loading, and for obtaining a more accurate mixture of sizes; concrete bins spanning two tracks; speed reducer drives on all machines except the crusher; exceptional safeguarding of equipment to eliminate accident hazards; individual motor drives throughout; all motors totally enclosed, dustproof and ball-bearing equipped; motor-starting panels of the enclosed magnetic contactor type and connected for sequence of operation. This plant was described in the May 26 issue of ROCK PRODUCTS.

The Pennsylvania Slag Co. completed a new sand plant at Emaus, Penn., and handle this material along with their regular line of crushed slag products. The Ohio Materials Co., Cleveland, purchased the American Slag and Supply Co. The Ohio Slag Co., Cleveland, was incorporated during the year.



Steel bins for crushed stone built at Worcester, Mass.

Uses of Graphite

NATURAL GRAPHITE is used chiefly in the manufacture of foundry facings, pigments and paints, crucibles, pencils, commutator brushes, stove polish, lubricants, retorts and batteries, says the United States Bureau of Mines, Department of Commerce. During the last few years the use of graphite in the United States has undergone radical changes. Uses that a few years ago consumed a large proportion of the supply are now relatively of minor importance, and uses which were unimportant have become important. Before the world war the manufacture of graphite crucibles consumed more than one-half of the supply; in 1923 only 15% of the graphite used in the manufacture of finished products was used in the manufacture of crucibles and in 1924 only 13%. Foundry facings used only 10% of the graphite in 1913; the quantity so used in 1923 was 44% and in 1924 it was 52%. Other uses that were minor before the war and are now of much importance are in pigments and paints, pencils and crayons, commutator brushes, stove polish and lubricants.

Graphite is manufactured at Niagara Falls, N. Y. This branch of the industry was started in 1897, under patents obtained by Dr. E. G. Acheson, and was developed so rapidly that after 10 years the production of artificial graphite exceeded that of natural crystalline graphite.

Sand and Gravel Industry Has Much Building Activity in 1928

Production Is Estimated About Equal to 1927 Figures, but Prices Are Lower

FROM returns on our questionnaires, from a survey of the car loadings during the year, and from general observance of the conditions in the larger producing fields, it is estimated that the production of sand and gravel in 1928 will be practically on a par with the production for 1927, when approximately 195,000,000 tons were produced. This is exclusive of silica or glass sand which brought the total of all kinds of sand recorded by the United States Bureau of Mines up to about 197,500,000 tons in 1927. If there is any change it appears to be toward a slight increase in the tonnage, but the trend is not marked enough to base a definite prediction upon.

In the f.o.b. plant prices there is indicated a very definite trend, however. Few operators report an increase in prices while the tendency over the whole country seems to have been downward, so that it would not be surprising to find the value of the 1928 production appreciably lower than that in 1927, although the tonnage remains about the same. The estimated average price in 1928 is about 2½ to 3% lower than in 1927. Present prices in many parts of the country allow little margin for profit, except with the best managed plants.

Construction Activity

But if the industry has lost in productive value during 1928 it has gained in stability. This is shown by the building of new plants of better design and construction, by the financing of strong companies and consolidations of groups of companies and by a very considerable new investment in deposits to be held in reserve.

A comparison of the records of new plant construction for 1927 and 1928 shows that there was fully as much in 1928. This can only be explained, in the face of a non-increasing demand, by new plant construction for economic reasons. Obsolete plants, which cost too much to operate, or which could not produce a material up to standard, have had to be replaced with new plants as the only sure means of "keeping out of the red." In 1928 there was less room than ever in the industry for the inefficient plant and operator and the poorly prepared product. Market conditions exclude inefficient operation and more rigid specifications are excluding the poor product, although not to the extent that they should.

There is, however, another angle to the plant building of 1928. This is that existing plants have been steadily at work increasing and improving their facilities so that the questionnaires indicate an increase of well above 10% in the capacity of these plants, despite the fact that there is no apparent increase in total production. For the most part these improvements have been minor, such as a new shovel, a larger dredge, or better screening equipment, but the fact indicates a sound belief in the future of the industry, and a general desire and willingness to keep pace with the leaders. Moreover, the present plans of the industry call for an increase of more than 15% over the 1928 capacity, which again points to a faith in the gravel industry, even though these projected plants may never get beyond the blueprint stage.

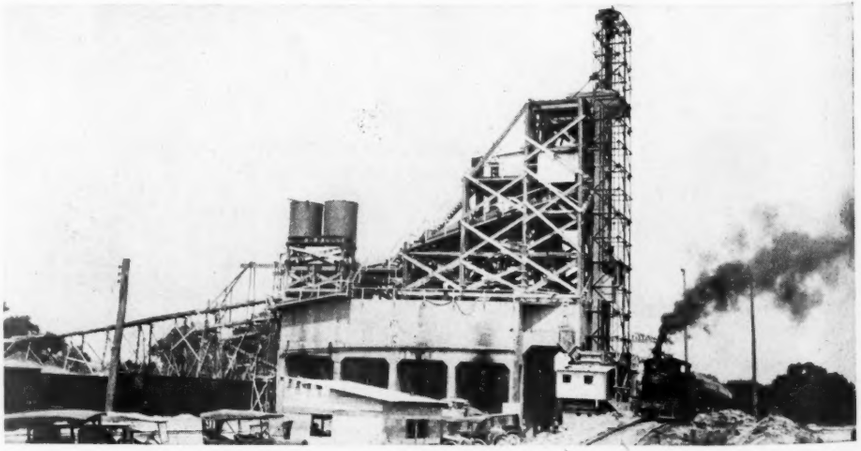
Development of Trucking Plants

Prominent in the 1928 development is the place of the "trucking plant," which has become increasingly popular over the whole country during the year and has shown itself to be in an impregnable position, in many cases, as regards competition from the larger operations. It does a retail business and loads most of its deliveries from the bin, thus avoiding the cost of shipping to distributing points, unloading the cars and storing the material, which the large railroad plant must meet to reach the same market. The saving is more than enough to balance any difference in operating costs, due to the larger tonnage.

Not that the tonnage of a trucking plant is so small, at that. Many of them produce from 1000 to 1500 tons per day, and a few of them produce 2000 tons daily. Special types of trucks and trailers have been designed for handling the product, reducing the cost and enlarging the area of shipping to a remarkable degree. Although this is not a development of 1928, the growth of the trucking plant in importance has been so marked in the past year that any review of the industry should mention it.

At the same time the weight of the business must be carried by the large plant and combinations of plants. Those in charge of large building operations want the material to be delivered in a limited time and cannot wait for the small plant to produce it. How great an order may be, and equally how great are the resources of one large producing company, is illustrated by the aggregate required recently for a large California hydro-electric proposal. Seven million tons of sand and gravel were required and one company was able to bid for all and guarantee delivery as required. There are other companies in the United States that could take the same order, although only 11 states produce that much sand and gravel in a year.

The market's demand for large tonnages in a short time is one factor that has induced the formation of large companies and consolidations. Another is the control of resources. There is still plenty of sand and gravel in those parts of the country where the industry is most developed, but only a limited proportion of it can be worked profitably at present prices. To name a few of



The new plant of the Sturm and Dillard Co. at Circleville, Ohio, which went into service early in the year

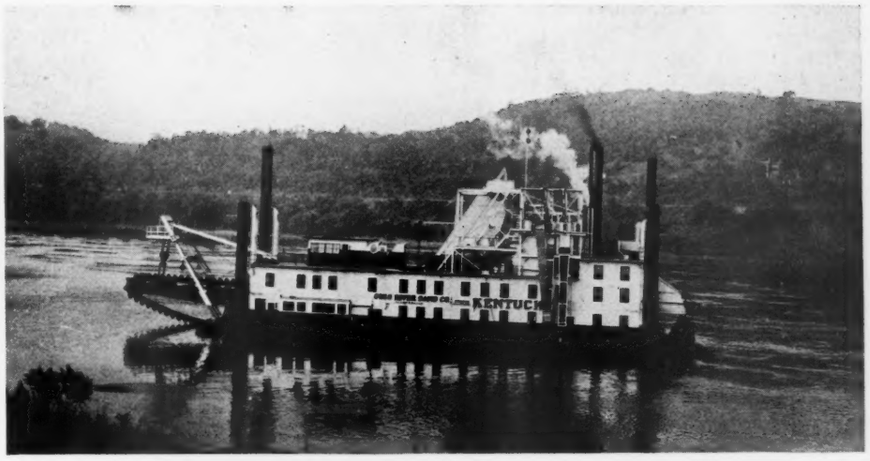
the conditions, a profitable deposit must be directly on a railway or water route; it must have sufficient depth and continuity to admit of mechanical excavation; the tonnage must be sufficient to justify a heavy investment; it must not contain too much material to be washed out or any deleterious material that cannot be washed out; and there must not be too much of unmarketable sizes. Deposits meeting all these conditions are now not easily found even in the richest sand and gravel districts, and the companies that wish to keep on beyond the exhaustion of a single deposit recognize this and are buying or leasing deposits to hold as reserves.

Hence good gravel land brings a good price, and some sales made in 1928 illustrate this. One large tract in Iowa was bought for $1000 an acre, and another, where conditions were not quite so good, was bought for $600 an acre. A little over $1400 an acre was paid for 1150 acres of the famous Tullytown, Penn., deposits, near Trenton, N. J. In a condemnation suit, the supreme court of Kansas gave $82,000 damages for 5½ acres of sand and gravel land (which had some equipment on it), although the lower court jury was willing to allow only $8800. Probably prices in 1928 for good gravel land were as high as they ever have been.

Severance Taxes

A burden placed on the industry in recent years has been that of a "severance" tax, a tax on almost anything separated from the soil, which a number of states have adopted. There had been some feeble protests, but in 1928 really serious objections were made to it. A notable instance was the attempt of the states of Oregon and Washington to collect back severance taxes on gravel taken from streams. The amount was so large that it would have bankrupt the producers who had it to pay. The tax of 10c. per ton was reduced to 5c. on the showing of the producers that collecting the higher tax would put them out of business, the matter of back taxes was left unsettled. In Louisiana, where the tax is a percentage of the value in the ground, one assessor fixed this value at 45c. per ton, which would make gravel land of ordinary depth worth as much as downtown lots in a big city. Producers rightly object to the severance tax, since it is in effect a sales tax, but they object even more to the way it is imposed by those who know nothing of the business and do not care to inform themselves about it.

Throughout the past year there have been constant statements that the gravel industry is "overplanted," at least in some territories. Strangely enough, most of the complaints have come from the producing fields adjacent to the large metropolitan areas where normally most of the production would be used. Unquestionably there is a concentration of plants in these areas, and frequently favorable freight rates have permitted the bringing in of sand from considerable distances to compete in these local markets.



The new dredge, "Kentucky," of the Ohio River Sand Co., Louisville, Ky., operating on the Ohio river

The result has often been a price war or something approaching very close to it. Such conditions have existed notably in California, the area surrounding Chicago, and in New York State. The building of new plants under such conditions has brought forth the disgust of the pioneer producers of the affected area, and frequently has resulted in considerable monetary loss to both new and old producers.

For the most part, highway construction has kept pace with its previous records, but the amount used for this essential work is spread out thinner over more plants than formerly because of the presence of added plants.

In commenting on overplanting, the majority of producers seem favorable to some sort of regulation in the placing of new plants. A few operators voice an objection to any sort of legal regulation from either government or the industry. But it is noticeable that some of these conclude that the newcomer "will find out as soon as he starts operating." The various producers' associations have worked generally in an educational way to discourage the entrance of unqualified operators into any producing field, but there has been no real crystallization of opinion along this line in the past 12 months.

Another source of vexation to the regular producers during 1928 (as always) was the presence of wayside pits, used particularly for highway work. This has been especially so in the Middle West, the producers of one state complaining that they have been unjustly discriminated against by the various highway organizations in favor of the roadside pit. Mississippi Valley state governments also come in for condemnation for operating their own pits. As one producer in the territory says, "Our competition is from our best customer—the state."

Consolidations

An increasing tendency for producing companies to unite by groups into large organizations has been noted in the industry during the past two or three years. This culminated in 1928 in the formation of some very large organizations, large not only because of the physical assets they control but because of the extent of the territory served. The greatest of all is the American Aggregate Corp., formed early in the year from the Greenville Gravel Corp. after it had acquired some other plants, especially plants in the Detroit district. Nineteen plants, of which a dozen or so were of the Greenville corporation, were included in the original financing, details of which were published in the May 12 issue. Afterward some of the principal plants in the vicinity of Cincinnati and Indianapolis were acquired.

The operations of this consolidation are so widespread that there is hardly an important place in Ohio, Southern Michigan and Indiana that its shipments cannot reach. And this territory includes such cities as Detroit, Cleveland, Cincinnati, Indianapolis, with others of the first class and many rapidly growing smaller cities and industrial towns. The states mentioned produced about 40,000,000 tons of sand and gravel in 1927, and the plants of the big consolidation have a production not so far below a third of this. It is to be noted, however, that the relation of plant capacity to market in the territory covered has not been changed. No new plants have been added and only a change of ownership was involved.

An interesting point in the financing is the new capitalization per ton of output. The assets of the consolidation as originally formed, with 19 plants, were stated to be $6,366,365, and the output for 1928 is estimated to be 9,000,000 tons. This figures to about 71c. per ton of annual production.

In point of capital involved and tonnage produced, the next largest consolidation was that effected by the merger of the Consumers Rock and Gravel Co. and the California Materials Co., both of Los Angeles, Calif. These two companies had nine large plants, the combined capacity of which is stated to be 21,000 tons per ten-hour day. One of these is the new Baldwin Park plant, near Irwin, which can produce 6000 tons daily. The combination is called the Consumers

Rock and Gravel Co., a Delaware corporation.

It is claimed that this consolidation supplies 30% of the rock (crushed boulders), sand and gravel used in the Los Angeles district of five counties, or say 4,000,000 tons in times of normal production. The assets of the company were stated to be $5,341,982 at the time of the consolidation, which, on a basis of 4,000,000 tons, figures out to $1.33 plus, per ton of yearly production. Details of financing were published in the August 4 issue.

An important consolidation was effected in Canada during the early part of the year when five of the important producers of Ontario were united to form Consolidated Sand and Gravel, Limited. These were: Durham Sand and Gravel Co., Durham; Waterford Sand and Gravel Co., Waterford; Superior Sand and Gravel Co. and Paris Sand and Gravel Co., Paris; and Fuller Gravel Co., of Fuller. They are all situated in a progressive industrial section of Ontario where the market is constantly growing. The Waterford and Superior plants were new last spring. The former is a dredging operation using equipment furnished by the Morris Machine Works, Baldwinsville, N. Y., while the latter is a Link-Belt plant.

The total production was stated in the consolidation's financial advertising to be 1,615,000 tons and the annual earnings, with all charges deducted, it was estimated would be $224,000 per year. Details were published in the June 23 issue.

There were other combinations of two or more companies formed by one company buying out another or joining forces with its rival, and these will be found in the record of changes and improvements given elsewhere in this review. There were also distributing organizations formed to handle the production of groups of producing companies. Perhaps the largest of these was the Metropolitan Sand and Gravel Co., of Boston, mentioned in detail elsewhere.

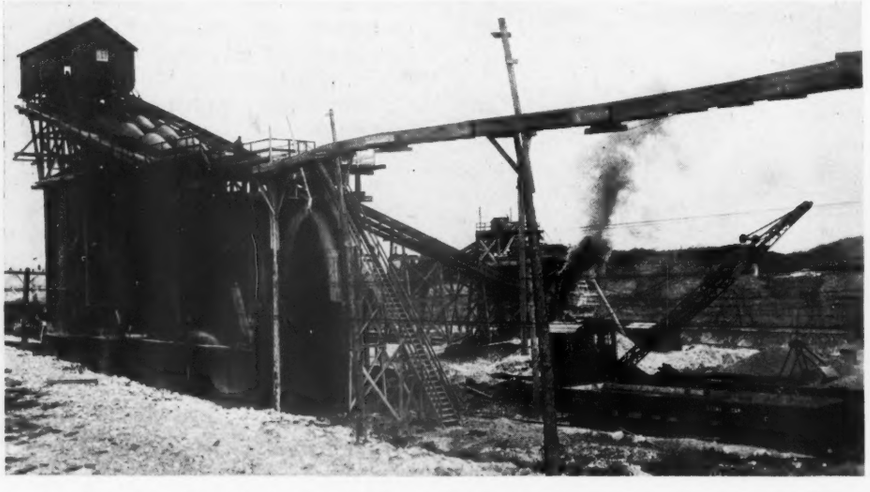
The plant of the Waterford Sand and Gravel Co. at Waterford, Ont., completed in April. This company is now controlled by the new Consolidated Sand and Gravel Co. of Toronto

Technical Progress

In excavating, perhaps the most important development is the growing use of movable plants in those sections of the country where the deposits are adapted to them. There is nothing new, of course, in the use of plants that can be easily moved, as these have been used for years by contractors and wayside pit operators. But their employment in large scale and continuous operations is a comparatively new development, and it may be said to have reached its climax in the all-steel plants built in 1928 by Gemmer and Tanner for their operations at Columbus, Texas. These plants are well designed machines, heavily constructed and capable of large outputs, up to 40 or even 50 cars per day. They were described in the April 28 issue. Somewhat similar machines are being used in Oklahoma by the Yahola Sand and Gravel Co., Muskogee, which were described in the July 21 issue. The Fort Worth Sand and Gravel Co. introduced this system of working in the Trinity River deposits, not far from Dallas.

The method is only profitable with flat deposits which are not too deep and scattered river bars with barren ground between, such as are worked by the Yahola company. It might perhaps be applied to thin outwash deposits of glacial material, but the greater number of deposits on which it can be used are old river terraces and scattered river bars. These are found in the Southern and Southwestern states, where the method was developed and where it will probably find its greatest use.

There is a tendency to employ dragline excavators and steam shovels even with plants of moderate tonnage as pits are opened wider and the demand for tonnage increases. Installations of these were noted in the past year that show that operators are considering flexibility and low operating costs rather than first cost. On the other hand, the scraper bucket and the cableway excavator are more than holding their own in plants that are opening new ground and plants built for truck delivery. With the last, the combination of low operating cost and a limited tonnage renders them particularly acceptable.



Another new plant of the Consolidated Sand and Gravel Co., of Toronto. This plant at Paris, Ont., commenced operations in May as the Superior Sand and Gravel Co.

Pumping Equipment Progress

In pumping, while the standard centrifugal pump is still almost without a rival, experience during the year has shown that there are possibilities of improving its design. The P. Koenig Coal Co. tried out a design of its own at one of its Oxford, Mich., plants with considerable success. The runner was made smaller and the plunger space was lessened and a lessened power as well as a lessened repair and replacement cost resulted.

This same company also introduced a cutter, the first to be installed in the district, with this pump. This is notable because the operators of the district have hitherto be-

lieved cutters unnecessary. It may be said that during the past year the use of cutters became so firmly fixed that now they are figured as part of the original equipment of a dredge of any consequence. It is no longer customary to wait until the need for one develops.

The Ward system of hydraulic jet excavation has been mentioned in the two previous annual reviews of the industry, and in this it may be announced that the device has passed the experimental stage. A very large dredge with two jets (one always held in reserve) was built by the Ward Sand and Gravel Co. in 1928. A capacity of 1003 tons per hour for one jet resulted. The dredge was described in detail in the October 27 issue. The Roquemore Gravel Co., Montgomery, Ala., installed a similar dredge, using the Ward system, at its new operation at Flomaton, Ala.

The use of tractors and trucks for bringing material from the pit to the plant was mentioned as new in last year's review. No such novelty in transportation methods developed in 1928 and the use of tractors and trucks for such work does not seem to be increasing.

Field conveyors have been installed in some places, but in at least one important operation a field conveyor has been displaced by dinkies and cars. The choice of a transportation method seems to be a matter of the distance to be covered, other things being equal, and for the longer distances cars and dinkies have no present rival.

No new development in barge transportation has been noted.

While the method of dewatering in double sumps, segments of a circle, is not new, its first application to a modern plant of large tonnage was made during the year, at the Morton Sand and Gravel Co.'s plant, Wayne, Ill. It was described in the September 29 issue.

The self-unloading boat "J. E. Savage" receiving the first load of sand from the new unloading equipment of the West Michigan Sand and Fuel Co.

As to washing and screening practices, the tendency to use vibrating screens in the place of rotary screens is accelerating and new forms of these are noted in the new machinery sections of this and preceding issues. Hydraulic classifiers exclusively designed for sand washing were first placed on the market during the year.

Development in Self-Unloading Boats

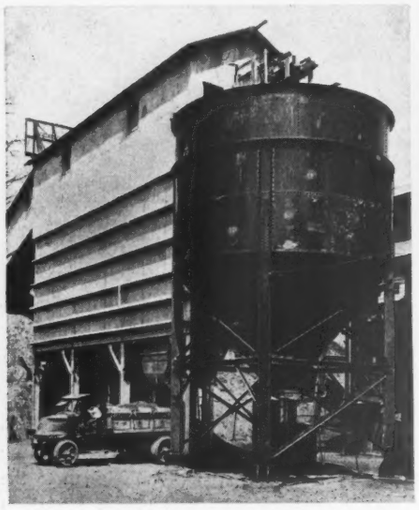
During the past year considerable activity has been shown in the development of self-unloading boats for use in handling sand on the Great Lakes. This development was at first marked only by additional refinements in design of the new or remodeled boats which have gone into this service during the past year. Although there are some ten or a dozen self-unloading boats operating on the Great Lakes, only five of these are new to the service this year. Of these five, the *E. M. Young* is being used for transporting limestone for the Great Lakes Portland Cement Co., and the *Sinaloa* is in the business of carrying sand, although it also carries coal on return trips, and may sometimes carry limestone. The *J. E. Savage* of Buffalo is the third of the Leathem D. Smith boats to be outfitted this year. All of these boats use Sauerman Bros. scrapers operating in longitudinal tunnels to unload the material. The other two boats were outfitted in Cleveland during the past year by the Webster Manufacturing Co. of Chicago. They are the *Sandmaster* and the *Fitzgerald*. The former was outfitted for the Interlake Transportation Co. and is now being used for bringing in sand from Lake Michigan to the Chicago area by the Construction Materials Co. of Chicago. It does its own dredging, thus being different from the three new Smith boats, which are only carriers. Some of the earlier Smith boats are equipped for dredging, however.

The Great Lakes sand boats in the district around Chicago have recently received considerable adverse criticism from the public and press because of the delay caused to street traffic when a boat passing through the Chicago river necessitates the raising of the bridges. On the face of it, this may seem a trivial thing, but the city's contention is that during a single year one particular boat has delayed traffic at only one bridge a

The swinging inclined conveyor and the A-frame which supports the conveyor on the S. S. "Sinaloa"

One of the four 8-yd. scrapers in tunnel below the material bins on the "E. M. Young." The side panels swing allowing material to pass into the tunnel. The scraper carries the sand or stone to a raised hopper

total of 33 hours, and that this is multiplied by the total number of bridges the boat passes in each trip. This means that the one boat delays traffic from 200 to 300 hours during just one year. It is also stated that three of the sand boats cause practically half of the bridge delays in Chicago. To meet this adverse criticism the Smith-Putnam Navigation Co. is designing and building a sand boat which will be able to pass under



New 500-yd. sand bin at the handling plant of the Commonwealth Quarry Co., Summit, N. J.

the river bridges and hence will cause no traffic delay. The Smith-Putnam company is a partnership between Leathem D. Smith, who has previously built and remodeled many boats for the sand business, and Maj. Rufus W. Putnam, who was formerly engineer in charge of the Chicago harbor area for the War Department. The new boat will not have the high fixed superstructures which were previously used, but will have frames which can be lowered to the deck when passing under a bridge. A second feature of the new boat will be the use of twin Diesel engines, which will give off little smoke, thus meeting another objection that public opinion has held against river traffic. The new boat is expected to be completed and ready for operation by February of next year.

This boat is unquestionably the only real development in the field of sand transportation by water during 1928. It is frequently predicted that when the boat is placed in operation early in 1929, the older style of boats will face sufficient protest from the public to make them change their present mode of operation. The Smith-Putnam boat will be used by the Material Service Corp., a new Chicago producer which has not been an offender in the previous contentions, and is building the boat now so that when it builds up a future river traffic it will not be delayed by new bridge laws, public opinion, or fixed bridges which probably will eventually replace the present drawbridges.

These developments in large water shipments are of peculiar interest at this time because of President-Elect Hoover's many times repeated advocacy of a large-scale development of our interior waterways. Logically, the largest use of such waterways will be for the transport of bulk cargoes like sand and gravel, as well as agricultural commodities. This kind of rock products traffic has developed enormously on the Great Lakes in the last two or three years.

New plant of the Chillicothe Sand and Gravel Co. at Chillicothe, Ohio

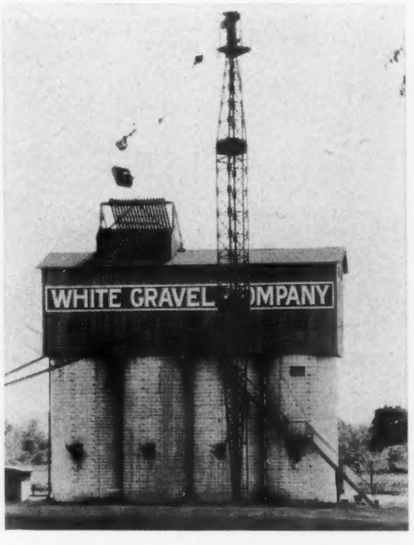
Notable Plants of the Year

Although the construction of new plants has been general over the whole country, there have been few really outstanding plants of large production, even less than in 1927, when the number was not great. The East shows no exceptional plant constructed during 1928, although the Massaponax Sand and Gravel Co.'s new plant at Arundel, Md., is a fine example of a modern all-steel plant. It is Link-Belt designed and equipped. In the Central West, the plant of the Sturm and Dillard Co., Circleville, Ohio, is the most notable. This is a pit operation turning out between 4000 and 5000 tons daily of washed and graded material. The plant, which is also of Link-Belt design, has a number of unusual features. One of the most outstanding is the use of a large skip hoist to raise the material to the top of the plant, thus doing away practically entirely with belts and conveyors at the operation.

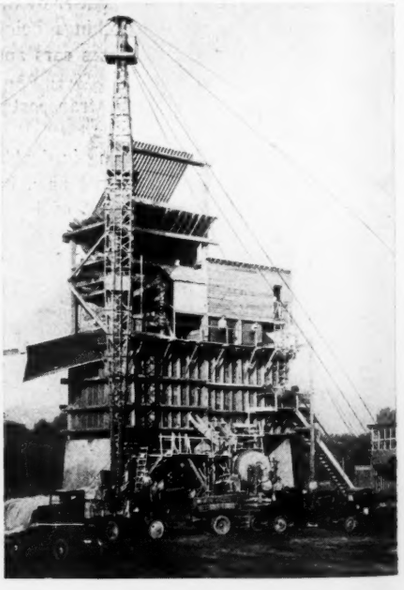
In the South, as usual, the Montgomery, Ala., district furnishes two fine new examples of modern sand and gravel plant building—one the Alabama Sand and Gravel Co., at Montgomery; the other the Roquemore Gravel Corp., at Flomaton. The latter plant represents the latest engineering achievement of the F. M. Welch Engineering Co., Greenville, Ohio. The combined capacity of these two plants is in the neighborhood of 400 cars per day.

Three notable new plants were erected in Texas during 1928: For the Gifford-Hill Co., Dallas (W. H. K. Bennett Co., engineers, Link-Belt equipment); the Inge-Farrel Sand and Gravel Co., Dallas, Link-Belt equipped and designed, and the Saxet Sand and Gravel Co., Victoria (another plant designed by Bennett Co. with Link-Belt equipment).

In the Far West, a number of good-sized plants began operations during 1928. One of the most important of these is the new operation of the Consumers Rock and Gravel Co., at Irwindale, Calif., which was constructed at a reported cost of $1,000,000.



A new plant in which cement staves were used in the construction is that of the White Gravel Co., Camden, Ohio



The new plant of Samuel Hensel at New Philadelphia, Ohio

Developments by Districts

It would be impossible to mention all developments, new plants, etc., within the short space allotted to this review. The most we can do is to touch a few high spots.

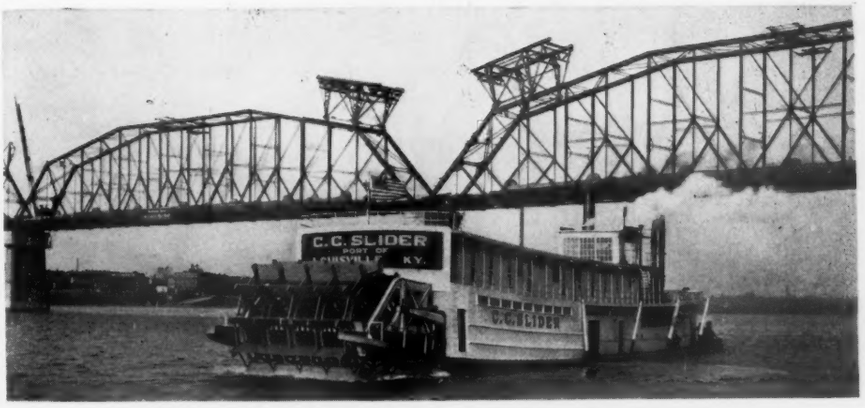
NORTHEASTERN STATES

In this section of the country there was an apparent lowering in both the production and the price. The New England plants generally show poorer business conditions than in 1927. New Jersey and New York likewise showed a definite trend toward a quite considerable decrease. The only state in the region which seemed to be holding its own was Pennsylvania. Judged as a whole the Northeastern states will probably show a decreased production of possibly 5% to 7%.

New York will probably show the largest production of sand and gravel in the country just as it has for several years past, although it is possible that it may be surpassed by Illinois. In 1927 the production from New York was close to 20,000,000 tons, only slightly more than that of Illinois. All of the old producers reported losses in production ranging from 10% to 30%, except two, and of these two one reported no change and the other a 10% gain. However, a good number of new plants was constructed during the year, many of which ran for practically the whole season, and it is almost certain that the production from these will bring the total up equal to the 1927 figure. The decrease in prices is particularly striking in this state, not a single producer reporting a gain, while the decrease was variously reported as from 2% to 25%.

New Jersey prices were about the same as in 1927 and production was about 20% less. Business has not been so strong in this state during the past year, and predictions for 1929 indicate no great change.

In Pennsylvania, about as many producers reported increases during the year as reported decreases. Hence, general business was going along about as it did in the previous year, most of the operators also showed an average selling price to be about the same. Some improvements were completed during the current year and others are planned for 1929 indicating that the operators feel that the conditions are generally healthful.



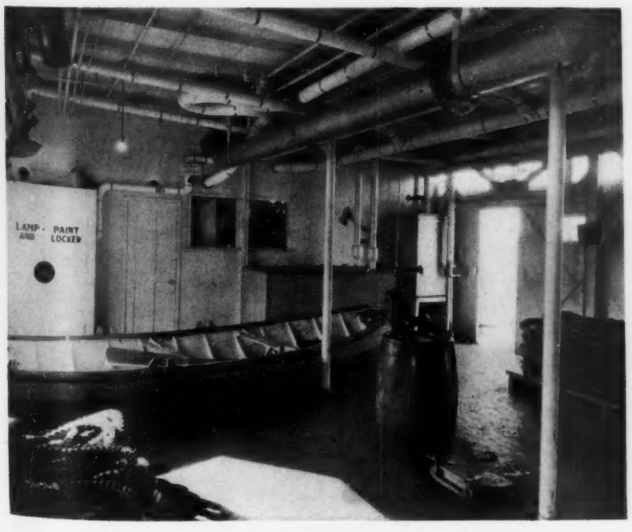
E. T. Slider's new towboat "C. C. Slider" on the Ohio river

Significant events in the Northeastern States were: The organization of the Metropolitan Sand and Gravel Co. of Boston, a distributing organization to handle the production of four of the larger operators of the Boston area. In New York State, the incorporation of several important companies and the building of a number of plants. The Diamond Sand and Navigation Co. was formed at Buffalo to operate four sand boats out of that city and other lake ports. New Jersey had two consolidations. The Lakewood Sand and Gravel Co., Lakewood, was bought by the North Jersey Quarry Co.; the New Jersey Sand and Gravel Co. bought the Warren Sand and Gravel Co. In Pennsylvania, the Van Sciver Corp. bought new large acreage at Tulleytown, took over the Geeorge A. Sinn plant at Frankford; also added largely to its yards and distributing facilities at Philadelphia. The Keystone Sand and Supply Co., Pittsburgh, improved its plant and added eight of the very large flush-deck steel barges. The Oil City Sand and Gravel Co. organized to work bars in the Allegheny river near Alcorn Island. In the District of Columbia the Columbia Sand and Gravel Co. erected a 5000-ton storage plant in Washington. The Smoot Sand and Gravel Corp. added one new dredge and 12 new barges.

CENTRAL STATES

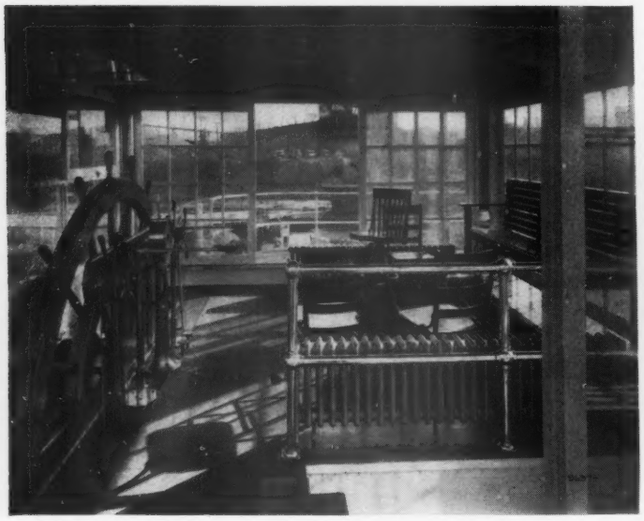
While most of the other sections are indicating losses in production for 1928, the states bordering the Great Lakes generally show substantial gains and excellent business conditions. Every one of these states has been a leading gravel producer, the region as a whole producing approximately 35% of the total production of the country during 1927. This amounts to about 69 million tons out of a total production of more than 197 million tons in the United States. Illinois with more than 19 million tons leads the section and was second only to New York in the country as a whole in 1927. Michigan, Ohio, Indiana and Wisconsin follow closely after.

From this section there is a continued complaint of over-planting, and this has resulted in quite marked price drops in most of the territory. There seems to be an ample market, however, as the producers generally report increased production and there has been a considerable tendency shown toward making improvements, which will increase plant capacity in all sections of the territory.



Below-decks on the steamboat "C. C. Slider"

Owner's quarters on E. T. Slider's Ohio river boat



Pilot house on the "C. C. Slider"

The new plant of Schmidt Bros. Sand and Supply Co. at Garfield Heights, Ohio

It is estimated that the gains in production here will be greater than 5% and may even reach as high as 10%.

The trend toward an increased production is not as marked in Ohio as in some of the other states, but it is well enough defined to be evident. Prices took a sharp tumble here, as only one operator reported an increase, which was slight, and more than half reported decreases ranging from 5% to 25%. Half of the plants reported some major improvements during 1928, and quite a number contemplated further improvements in 1929.

Only one producer in Indiana reported a decrease in production, while the others indicated an increase averaging about 10%. The prices were almost uniformly reported as the same as in 1927. Complaints of overcrowding in this territory are few, but one complaint made is against selling material below cost to break competitors. It appears that if fair prices could be maintained in Indiana the industry would be in a very satisfactory condition. Confidence in the business is expressed by the fact that the companies are going ahead with a number of improvements to increase capacity for the coming year.

Apparently producers in Illinois had the best year as far as production goes and the worst year in regard to selling price, as compared with operators in almost any other state. Only two companies report a decrease in production, while the other operators who answered reported an increase of from 5% to 50%. On the other hand, three operators reported slight gains in price, and all of the others reported decreases of from 5% to 20%. Improvements tending toward an increase in plant capacity have not been great this year, but prospects for more in 1929 are good, according to the various operators. A number of new plants increased the state's production so that the estimate for 1928 should be about 10% more than in 1927.

Michigan, in general, had healthful conditions, with all but two producers who returned the questionnaires reporting substantial increases of from 5% to 30%. One producer reported a loss of 10% in production and another had stopped operating entirely for the year. Reports on price changes were not as complete as on production, but apparently the prices remained on the same level generally as in 1927. Confidence in the industry in Michigan was indicated by the number of producers who had made major improvements in their plants since the first of this year. The number reporting such additions was more than half of the total number reporting, and also more than half reported that further improvements were contemplated in 1929.

For Wisconsin, not enough producers reported to give a satisfactory estimate of the condition of the industry there, but from the questionnaires received and other sources of information it would appear that production in the old plants was somewhat curtailed, with the production from plants completed in 1928 bringing the total up to the 1927 figure, possibly slightly better; as in most of the other states of the central territory, prices apparently are considerably lower, and competitive conditions bad. There were a number of improvements reported as completed during 1928, with even more contemplated during 1929.

Notable events in the Central territory included the formation of the American Aggregate Corp., already referred to, and some smaller mergers. In Chicago metropolitan territory a new factor appeared in the market, the Material Service Co., which bought one of the few remaining large dock sites on the Calumet river at Chicago and built a distributing yard covering 7½ acres and having a dock frontage of 645 ft., and is now

The dredge and new plant of the Sand-Gravel Co. of Omaha at Oreapolis, Neb., in the Plattsmouth producing district at the junction of the Platte and Missouri rivers

Unloading sump to feeder hopper at the new Morton Sand and Gravel Co. plant at Wayne, Ill.

building a plant at Lockport, on the Chicago drainage canal, which is to have an output of 5000 tons daily.

There were a number of medium-sized plants built in Ohio during the year including that of A. J. Clementz and Sons at Massillon, a Morris dredging operation, the plant of Samuel Hensel at New Philadlphia, which uses a Sauerman cableway excavator, the plant of the White Gravel Co. at Camden, and the plant of the Chillicothe Sand and Gravel Co. at Chillicothe. The latter two plants were put up by Neff and Fry of Camden, with cement stave silos. The Diamond Sand and Gravel Co., the Buckeye Sand and Gravel Co., and the F. J. Schmidt Sand and Supply Co. combined to form the Schmidt Bros. Sand and Supply Co., and the new company built a plant at Garfield Heights near Cleveland. This is a Stephens-Adamson plant.

SOUTHEASTERN STATES

The Southeastern States generally and almost universally show decreased production and lowered prices. Not many new sand and gravel plants were constructed, but several new crushed-stone plants were, so it is safe to say that business conditions were poor practically uniformly over the territory, and that the demand was considerably below normal.

The bin and washing plant at the Panhandle plant

In Virginia, following the general trend over the whole area, there is a decided drop in production from the previous year. Indications are that the selling price may be somewhat higher but the small number of returns makes it problematical to decide whether the price was higher or substantially the same.

The plant of the Panhandle Sand and Gravel Co. nearing completion at Lockney, Texas

West Virginia conditions reported indicate that both price and production will be substantially the same as in 1927.

Few producers reported from Kentucky, but all were agreed that conditions were bad, with production necessarily curtailed and prices lower than in 1927.

Tennessee producers indicated that they had found about as much market as previously—that is, their production was about the same as in 1927—but they had been forced to sell for considerably less. The reports all showed decreases in prices ranging from 5% to 20%. No improvement seems likely for the coming year.

North Carolina producers reported a gain in production and one reported a 10% gain in his selling price. Another stated that his selling price was just the same as in 1927.

There has been considerable activity in Alabama during the past year, and though the reports do not indicate any increase, it is expected that the production will at least reach the 1927 figures, due largely to the establishment of several new plants. Answers indicate that the price was considerably decreased in 1928.

Mississippi reports were meager. One report stated that production was 10% less, but the price was the same in 1927.

Apparently conditions in Florida have been poor. One plant reported a complete shutdown on account of depression, and two plants report production curtailed 40% and 60%, respectively. All agree that selling price has been reduced 10% to 25%. The reporting plants stated that no improvements were made during 1928 and none were contemplated in 1929.

Significant events in the Southeastern States include the entrance of a Virginia producer, the Massaponax Sand and Gravel Co., Fredericksburg, into the Washington, D. C., market on a large scale. In West Virginia there were two new plants; one for the Moundsville Sand Co., the other for the Ohio Valley Sand and Gravel Co., Wheeling. The Superior Sand and Gravel Co., Charleston, acquired the Midway Sand and Gravel Co. of Parkersburg. In Alabama, besides Montgomery operations already mentioned, a number of other smaller plants were built, notably one for the Monroeville Sand and Gravel Co., Monroeville.

TRANS-MISSISSIPPI STATES

This section is marked by a quite considerable uniformity of the reports returned. In almost every state the producers report a uniform decrease in production, and just as universally a price level closely approximating that of 1927.

Iowa probably showed as satisfactory conditions as any in the territory, with about one-half the plants showing increased production and the other half showing a decrease. Three-fourths of those reporting said they were obtaining exactly the same price as in 1927. Moreover, half of the plants indicated some major improvements were contemplated during the coming year.

Of the plants reporting from Missouri, two had ceased operating completely and the others were practically evenly divided between increases and decreases. Prices likewise were almost exactly what they were a year ago, according to the producers. Except for two or three new plants, very little improving was done during the past year. However, with the production of these plants included, it is expected that Missouri's output will reach the 1927 figure.

As in other states of the agricultural belt, Nebraska producers reported production 30% to 75% less than 1927 but prices at approximately the same level. Conditions in Kansas were similar, but apparently not quite so much decrease in production.

Two Oklahoma producers showed respectively a 10% gain in production with no change in price and a 50% loss in production with a 30% decrease in selling price. The

former has completed some improvements and is contemplating more for 1928.

Noteworthy events in the Trans-Mississippi territory in 1928 included activity both in production and in new plants. In Iowa the most important was at Hawarden by L. C. Everist, Inc., of Sioux City. The Iowa Sand and Gravel Co. improved its plant at Eddysville; the Legrand Crushed Rock and Gravel Co. built a modern plant at Lake View.

The Stewart Sand Co., Kansas City, united with the Coen Building Material Co. under the name Stewart Sand and Material Co. Some new plants were constructed in Missouri, notably the 100-car plant of the Denton Sand and Gravel Co., St. Louis. A smaller plant was that of Johnson and Hudson, Sampsell.

The Consumers Sand Co., Topeka, Kan., built four new plants and improved a number of its other operations. The Schwartz Sand and Gravel Co. built a new plant at Wichita.

The Sand-Gravel Co., Omaha, Neb., opened a new plant at Oreapolis, near Plattsmouth, and the Lyman-Richey Sand and Gravel Co., Omaha, also opened new pits and plants in the same locality. The Parker Gravel Co. began operations at Fairbury.

In Oklahoma, the Yahola Sand and Gravel Co., Muskogee, built two more of the movable plants of its own design. This company now operates seven of these plants.

SOUTHWESTERN STATES

Reports indicated a satisfactory condition of the business in these states.

Reports from Texas indicate much activity. Only one producer reported a loss in production, while two-thirds of the operators showed gains of from 5% to 50%. With several new plants placed in operation, the production should exceed the 1927 total by at least 5%. A trend toward lowered prices was indicated, but fully half that answered said there had been no change in price one way or the other. Almost every operator reporting told of some major improvement during 1928, and contemplated further improvement next year. This, with the new plants now being constructed, indicates that producers have a faith that here is a substantial market.

From Arizona few reports were received, but all indicated an increased production and increase in prices from 10% to 25%. Conditions are good, with the producers contemplating considerable improvements in 1929.

Some events of interest in the state of Texas were the announcement of the Panhandle Sand and Gravel Co., Lockney, Tex., to build a new plant. D. H. Ryan built what is said to be one of the largest plants in the state on the Colorado River at Ballinger, near San Antonio. Gemmer and Tanner, Inc., added two more of the movable dragline plants which are of their own design and construction; also a dredging operation at Eagle Lake, where they had previously used one of their movable plants. The Midland Sand and Gravel Co., Terrell, completed a new washing plant.

ROCKY MOUNTAIN AND PACIFIC COAST STATES

Reports from the Rocky Mountain states are too scarce to give more than a trend, but indications are that the business in this section was not so good during 1928 as in 1927. In California, also, the business is not so promising as it has been previously. Producers in this state have always made complaints of overplanting, and the questionnaires seem to carry out this contention.

California is one of the largest producers in the country, having ranked in fourth place in 1927 with 14 million tons. Conditions have been poor there for some time and the reports received indicate that this year was a continuation of these conditions. Two plants reported increases in production during the year, while more than half reported decreases ranging from 15% to 50%, and one plant had ceased operating entirely. Only one plant reported a price increase, while several said that the price was the same, and half declared there was a reduction of 10% to 30%. Overcapacity was complained of and the building of a number of new plants in 1928 has only aggravated the condition. Existing operators thought so little of the business situation that practically no major improvements were made in 1928 and few are contemplated in 1929.

Oregon producers reported an increase in production, with prices remaining practically the same as in 1927. Indications are that business has been good in this section, and the operators are going ahead with considerable plant improvements.

As in Oregon, the business in Washington has been in general good. Plant prices have remained stationary and there was some increase in production during 1928. No considerable complaint is made concerning overplanting, although there is noted some complaint in particular localities. Expectations for next year are considered good.

Sand and Gravel Operating Data

During the year, incidental to compiling a directory of the sand and gravel industry, ROCK PRODUCTS' research department has uncovered the following interesting statistical data on 823 companies operating 1272 plants producing 92% of the annual tonnage of the United States:

1. Aggregates other than sand and gravel reported:		% of companies
Crushed gravel	147	17.9
Crushed stone	18	2.2

2. Machines used in excavating:		% of total
Power shovels	432	29.6
*Draglines	235	16.1
Locomotive cranes	129	8.9
Cableway excavators	120	8.2
Hand methods	41	2.8
Loaders	12	0.8
Drag scrapers	34	2.3
Derrick boats	11	0.8
Derricks	6	0.4
Hydraulic sluicers	11	0.8
Graders	2	0.1
Dredging	425	29.2
		100.0

		% of dredges
Dredging	425	.....
†Electric	142	44.2
Steam	99	33.0
†Diesel	32	10.9
Gasoline	21	7.1
Kind not given	131	.....
		100.0

3. Producers of wet screened or washed material:		% of total
Number of companies	575	70.0

4. Methods of removing overburden (by companies):		% of companies
Power shovels	144	36.3
*Draglines	78	19.6
Teams and slip scrapers	48	12.1
Power drag scrapers	27	6.8
Locomotive cranes	26	6.6
Tractors and scrapers	26	6.6
Hand	23	5.7
Hydraulic	17	4.3
Contract, loaders, etc.	8	2.0
		100.0

5. New construction reported for 1928:		% of total
Number of companies	179	21.8
In which is included		
New dredges or pumps	20	
New plants	9	
New washing equipment	10	
Drying equipment	4	
Replace steam dredges by oil or electric	2	

*Some of the machines given as draglines are really power drag scrapers and cableway excavators, since some ambiguity exists in the field between the terms drag scraper, power scraper, dragline scraper, dragline excavator, cableway excavator, slackline excavator, etc.

†Some of the dredges under the headings Diesel and electric are Diesel-electric operated.

The percentage of excavating machines, of equipment that are dredges are shown here in per cent of *machines* only. The percentages of *plants* using the dredging method is approximately 40%.

The numbers of machines shown are, of course, not the totals in use in the field. They represent over half the plants and about 90% of the tonnage.

Sand and Gravel Company Incorporations Recorded in Rock Products During 1928

State	No. of incorporations	No. listed with no par value given	Capitalization†
Arkansas	3	1	$ 19,000
California	1	..	75,000
Colorado	2	..	45,000
Connecticut	2	..	100,000
Delaware*	6	2	1,780,000
Florida	1	..	10,000
Georgia	1	..	60,000
Illinois	5	2	182,000
Indiana	6	..	93,000
Iowa	2	..	110,000
Kansas	7	1	235,000
Louisiana	4	1	103,000
Massachusetts	3	2	99,900
Minnesota	1	..	50,000
Michigan	5	..	370,000
Mississippi	3	..	230,000
Missouri	2	2	.....
Montana	1	..	50,000
Nebraska	1	..	20,000
New Jersey	10	3	1,275,000
New York	16	8	247,000
North Carolina	2	..	175,000
North Dakota	1	1	.....
Ohio	16	5	510,000
Oklahoma	2	..	30,000
Oregon	4	..	200,000
Pennsylvania	2	..	115,000
South Carolina	1	..	35,000
Tennessee	2	..	62,000
Texas	7	3	171,000
Washington	6	..	257,000
West Virginia	2	..	75,000
Wisconsin	4	..	210,000
Total, 1928	131	31	$6,993,900
Total, 1927	167	..	15,673,000
Total, Canada	7	..	2,360,000

*Represents companies with plants located in California, Texas and other states.

†Total of stocks listed with par value.

Lime and Lime Hydrate in 1928

No Loss in Tonnage But Prices for Year Lower Than for 1927

THE GROSS TONNAGE of all lime produced during the year was practically the same as for 1927, but the price apparently dropped about 45 cents per ton, which on the tonnage produced shows an estimated value of $35,759,000 for 1928. This compares with a gross value of $38,210,000 for 1927. The tonnage for 1928 is estimated at 4,200,000 short tons, and on this basis the average net price received would be $8.50 per ton, which compares with $8.95 for the previous year. These figures are based on the analysis of results published by the Bureau of Mines, Department of Commerce, but lime was sold in many places in the United States at prices less than that indicated by this tabulation. We do not believe, however, that production was appreciably less except in the East.

Prices of hydrated lime followed the general trend of prices, showing apparently a drop of from $9.14 per ton in 1927 to $8.70 in 1928, with practically the same production for both years. Chemical lime producers report a favorable year, with prices somewhat lower.

Apparently 12% of the year's production was shipped in barrels, 34% in paper or paper-lined jute sacks, and 54% shipped in bulk.

Lime Products and General Building Expenditures

One of the questions asked all lime producers was aimed to determine what percentage of the money spent for all building purposes was, in their opinion or estimate, spent for lime products. The replies were so irregular that a compilation was made using information from other sources, and for the year 1928 it is estimated that 0.445% of the value of all building construction or 0.4c per dollar went for lime products. The estimated value of all building for 1928 was over $8,000,000,000.

This comparison, starting with 1920, shows a yearly and steady drop in the percentage spent for lime products. This downward trend has been regular and each year, starting with 1920, there has been roughly a yearly loss of 0.07% in the total comparative values. As hydrated lime shows only a slight decrease, it is apparent then that the loss has all been due both to a decreased use of lime as a building material, and to decreasing prices for lime, relative to the price of labor and other building materials entering into construction.

Table I shows the amount of lime sold during the years indicated compared to the total construction for those years. For instance, in 1920 there was $3,600,000,000 of total construction, and a $37,543,840 value of lime products sold, or 1.04% of the total was for lime.

TABLE I

Year	All Lime	Building Lime only	Hydrated Lime
1920	1.04%	0.42%	0.258%
1921	0.71	0.38	0.212
1922	0.58	0.37	0.202
1923	0.73	0.41	0.226
1924	0.66	0.38	0.220
1925	0.58	0.32	0.202
1926	0.53	0.29	0.195
1927	0.46	0.27	0.180
1928*	0.445	0.26	0.180

*Estimated.

Lime, however, is not the only building material that has shown a gradual loss in yearly values when compared to the total value of building construction, as portland cement, sand and gravel, crushed stone, gypsum and slate all showed similar losses, although not so pronounced, while the total value of building has increased gradually from $3,600,000,000 in 1920 to over $8,000,000,000 in 1928, indicating that all these materials are selling at prices relatively lower than the other elements that enter building construction.

Table II shows the production and tonnage figures for 1920 to 1928 inclusive, the 1928 figures being our own estimates.

The lime industry for the past two years has been so torn apart through blind and unrestrained competition that many companies have been unable to show a satisfactory profit, and many reported operating at a loss. This condition has about reached the stage where the individual producers are beginning to wake up to the fact that they alone are responsible for this condition, and that the competitive methods they have used to sell plant capacities have been used by their neighbor producers just as effectively, and the result has been anything but happy.

Association Work

In the last few months there seems to have been a decided tendency for producers to want to discontinue the old cut-throat practices, and through their National Lime Association seem to be becoming willing to build up the industry as a whole and to try to regain the ground lost to producers of materials in other lines. There are many uses to which lime could be applied in increasing amounts, and the National Lime Association apparently will face the year 1929 with a large number of producers backing it, for they realize they face the problem of expanding the market for lime for the whole industry, or many may be forced out of the lime business entirely.

One evidence of activity in association work was the Ohio Finishing Lime Association of Ohio opening a district office at Atlanta, Ga. The parent association also issued a booklet during the year for distribution to the trade. The pamphlet was an outline of the purposes of the organization.

The low price received for lime products has resulted in several instances, however, in strenuous efforts to modernize quarry and plant equipment, to develop new uses for lime, and the extending of individual company research to develop a better product. There apparently are a few operators who realize that various grades of lime are capable of being produced from the various quarry ledges, and have set about to find out what portion of the ledge is best suited for producing lime for a particular need. Others have come to realize that their fuel consumptions are too high, and have set out to lower this cost item and to improve the burning practices in order to secure a better quality product.

In this connection it is noteworthy the large percentage of plants that are taking advantage of the possibilities of getting better fuel economies and temperature control by the use of recording pyrometers and other heat-measuring devices. Several companies use CO_2 recording instruments also. At the Batesville plant measurements were taken of the actual temperatures in the kiln. These temperatures were found to be 2400-2580 deg. F. in the hot zone.

The Peerless White Lime Co., Ste. Genevieve, Mo., deserves special mention as one that has done special research of a chemical nature aiming at better technical control, a better understanding of the basic principles of plasticity, and an investigation to increase kiln capacities with reduction in fuel costs.

TABLE II. LIME SOLD BY PRODUCERS IN THE UNITED STATES

Year	No. of hydrate plants in operation	Hydrated		Value per ton	Number of lime plants in operation	Total		
		Short tons	Value			Short tons	Value	Per ton
1920	98	853,166	$9,287,562	$10.89	515	3,570,141	$37,543,840	$10.51
1921	105	792,970	7,421,637	9.36	520	2,532,153	24,895,370	9.83
1922	114	1,106,063	9,868,980	8.92	530	3,639,617	33,255,039	9.14
1923	121	1,225,928	12,229,598	9.98	467	4,076,243	39,993,652	9.81
1924	120	1,316,664	13,199,846	10.03	450	4,072,000	39,596,423	9.72
1925	134	1,560,848	15,287,461	9.80	450	4,580,823	42,609,141	9.30
1926	147	1,606,811	15,182,460	9.14	435	4,560,398	41,566,452	9.12
1927	147	1,562,000	14,300,000	9.14	430	4,337,000	38,210,000	8.95
1928*	149	1,560,000	13,570,000	8.70	430	4,200,000	35,759,000	8.50

*Estimated by ROCK PRODUCTS.
Note that the number of plants, not operating companies, is given.

Getting out dimension stone in connection with the regular production of lime at the Western Lime and Cement Co., Marblehead, Wis.

New lime plant of Edwin A. Nast, at Marblehead, Wis., to which two more kilns will be added to bring the capacity to double the present output

This phase of the company's operation was described in detail in the September 10 issue of Rock Products.

The decrease in price has forced practically all producers to face the problem of disposing of spalls other than by wasting them, and has resulted in many operators using rotary kilns or crushing and screening this product for commercial crushed stone. Several lime producers are more in the crushed-stone business right now than the lime business. In Wisconsin the Western Lime and Cement Co., which is the largest lime operator in that state, also is shipping dimension stone and flaggings, in addition to crushed stone and their regular line of lime products.

An operator in Texas, using mixed-feed kilns, has increased his profits by using the ashes and fines for making "klinker" brick, following somewhat the practice used in the manufacture of sand-lime brick, but using the kiln cinders in place of sand—a process he invented and has patented. We give it as an illustration that the lime industry has reached a stage where operators must use their wits if they would make a profit.

New Rotary-Kiln Plants

During the year the Hoosac Valley Lime Co., at Sylonite, Mass., completed its modern plant equipped with two Traylor rotary kilns 8x150 ft. in size and two 6x50-ft. coolers. The plant will also pulverize lime. The Alabama Lime and Stone Co., Birmingham, installed two rotary kilns and a hydrating plant. A new plant using oyster shells as a source of limestone, owned by the W. D. Haden interests, Houston, Tex., is under construction. The plant was designed by Arnold and Weigel, of Woodville, Ohio, and uses one 7x125-ft. Traylor rotary kiln. The Bershire Hills Co., Great Barrington, Mass., also completed its rotary kiln plant started in 1927 and is using a 7x120-ft. Vulcan kiln. This plant is now in operation and the company expects to make some alterations during 1929.

New Plants Using Vertical Kilns

In the November 24 issue of Rock Products the new plant of the Batesville White Lime Co. was described in detail. This plant, one of the notable ones of the year, has a capacity of 150 tons of burned lime per day and includes a Kritzer hydrator and pulverized lime plant. The Everett-Saxton Co. started its 3-kiln plant at Everett, Penn., designed and equipped by the McGann Manufacturing Co. This plant was described in the April 28 issue of Rock Products. The Black Marble and Lime Co., Enterprise, Ore., entered the western field with a 3-kiln plant, which was described in the August 18 issue. A new 4-kiln plant is now under construction for the Nast Lime and Stone Co., at Marblehead, Wis., the company being headed by Edwin A. Nast. In Alabama, the Muscle Shoals White Lime Co. started operation of a 100-bbl. per day plant. The Florida Lime Products Co.'s Florala plant is reported ready to operate.

Another outstanding plant built this year was the new 4-kiln plant of the Walter T. Bradley Co., at Swatara, Penn. The plant was designed and built by the McGann Manufacturing Co., York, Penn., and has an R. B. Wood heavy duty gas producer capable of gasifying 4500 lb. of coal per hour. Geoerge Hoffer, resident manager for the Bradley interests, also assisted with the designing. A full description will appear in a later issue.

A new plant consisting of five kilns is reported to be under construction by B. L. John, Portland, Ore.

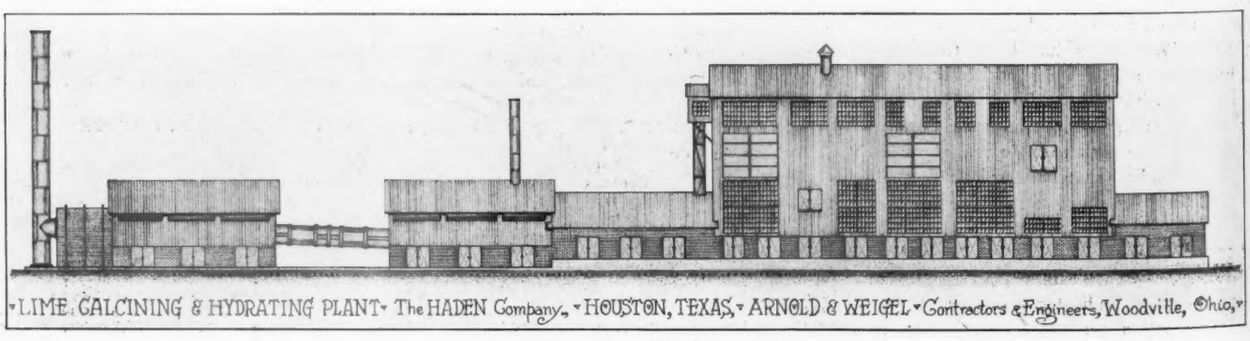
The Louisville Cement Co., Milltown, Ky., the West Virginia Pulp and Paper Co., Williamsburg, Penn., and the Washington Building Lime Co., Woodville, Ohio, are three manufacturers who installed new gas producer equipment during 1928.

Some notable plants were built in Canada during the year. The David Bowman Co., Winnipeg, Man., built a single kiln plant, notable, however, as being one of a few modern mixed-feed kilns built in North America. Coke is used for fuel. Waste from a dimension stone quarry furnishes the stone.

The Standard Lime Co., Montreal, Que., started operation of a new 8-kiln plant at St. Mare, Ont.

Some New Hydrate Plants

It is interesting to note that during the year 1928 there were at least nine new hydrating plants installed as follows: Bates-



Engineer's drawing for the new lime calcining and hydrating plant of the Haden company, Houston, Tex.

ville White Lime Co., Batesville, Ark.; Everett-Sacton Co., Everett, Penn.; Black Marble and Lime Co.. Enterprise, Ore.; Manistique Lime and Stone Co., Manistique, Mich.; Salem Lime and Stone Co., Salem, Ind.; Osceola Lime Co., Osceola, Mo.; Eastern Lime Co., Ltd., Windsor, Nova Scotia; Snow Flake Lime Co., St. Johns, New Brunswick, and Alabama Lime and Stone Co., Calera, Ala.

Three other plants are reported as planning to erect hydrators during 1929. They are the Mount Lime and Chemical Corp., Lynchburg Va.; Nast Lime and Stone Co., Fond du Lac, Wis., and the Bowman Lime Co., Winnipeg, Man., Canada.

Hydraulic Limes

Considerable interest is being shown in developing hydraulic-lime or natural cement-rock deposits, and incidentally it might here be said that this is one field that has apparent possibilities, yet is practically ignored by most lime producers. The Inter-State Cement Corp., of Delaware, has purchased a large acreage near Kingston, N. Y., and intends to manufacture a wide variety of lime, hydraulic lime and natural cement products. One of the oldest natural cement plants in the West, that of the Fort Scott Hydraulic Cement Co., Fort Scott, Kan., is reported enlarging its plant. Only the most obvious uses for natural cements and hydraulic limes have been developed.

Hydraulic limes are used in Europe even for wall plaster. Hydraulic limes are two kinds, natural, or lime made from an argillaceous limestone; and artificial, which is a mixture of high calcium lime and a pozzolana. It therefore lies within the range of every lime manufacturer to make a lime that would overcome some of the present handicaps of lime in the building industry.

New lime kiln at the plant of the David Bowman Co., Winnipeg, Man.

New Uses and Products

While the production of pulverized lime cannot be considered new, yet its adoption is spreading rapidly, especially in the Philadelphia territory, and the use of a waterproofed liner in connection with multiwalled paper bags and as a liner for cloth or jute sacks, is finding favor as a container for this material.

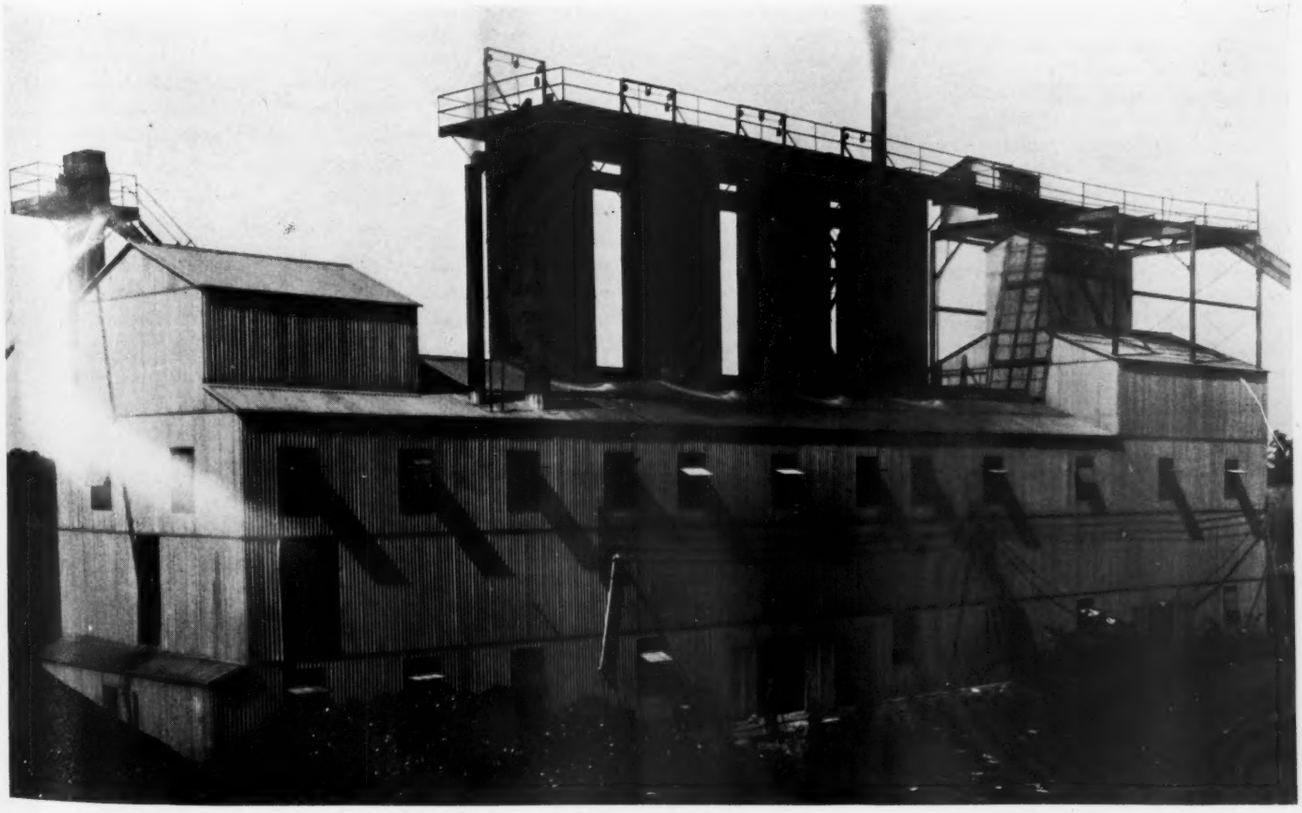
The extended use of lime in the oil flotation process, especially in connection with copper metallurgy, was responsible for a large percentage of the production in the Southwest, especially southwestern Texas. The field for such industrial uses of lime has hardly been scratched, and offers great opportunities for progressive development through intelligent research.

One thing noteworthy, and encouraging, especially among the larger lime companies, is the increasing use of magazines and newspapers as a means of advertising lime products, particularly in chemical and industrial fields.

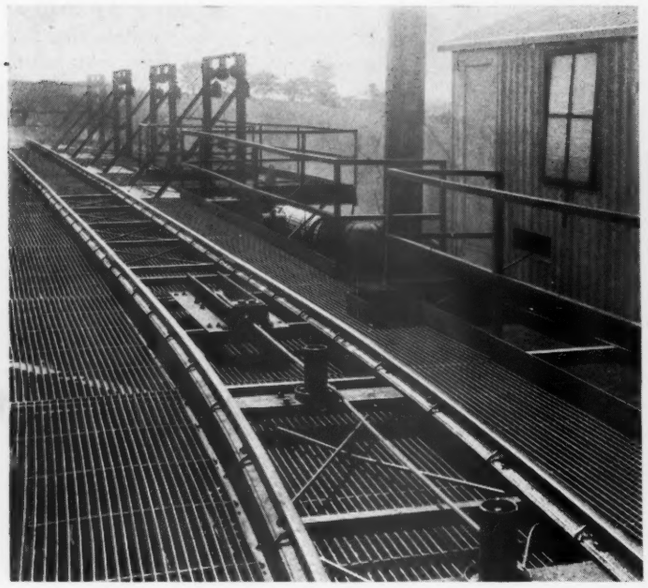
Lime as a base for colored and plain exterior stuccos was further developed during the past year.

Mergers and Consolidations

By far the most important merger of the year was the Inland Steel Co., Chicago, Ill., which through a newly organized subsidiary,



New four-kiln lime plant of the Walter T. Bradley company at Swatara, Penn., with the gas producer at the left



Top of the kilns at the Bradley plant, showing the hoist house, cable guides, and counterweighted door-raising mechanism

The picking table and storage tanks at the Swatara plant, with the end of the gas header shown at the top

the Inland Lime and Stone Co., took over the management and ownership of the Manistique Lime and Stone Co., Manistique, Mich. This company has quarries and kilns at Manistique, Marblehead and Calspar, Mich. Its most important operation is at Marblehead and consists of a modern 4-kiln plant and a hydrate plant now under construction. At Marblehead the Manistique Lime and Stone Co. owns or controls a large acreage of high calcium limestone, and the new owners propose to develop this limestone by operating a larger quarry and building docks at Seul Choix, as well as a new crushing and screening plant with a railroad from the quarry to the proposed docks.

This transaction is of utmost importance to the industry and its stimulating effect will no doubt be far-reaching. George J. Nicholson, vice-president of the Manistique Lime and Stone Co., was responsible for this merger and will continue as vice-president of the Inland Lime and Stone Co.

The Charles Warner Co. acquired control of the Merion Lime and Stone Co. of Morristown, Penn. The Legarde Lime and Stone Co., Gadsden, Ala., sold its holdings to a Pennsylvania corporation. The Pacific Lime and Plaster Co. and the United States Lime Products Co., of San Francisco, have merged and operate under the latter name. The National Gypsum Co., of Buffalo, bought the Lucky Lime and Supply Co., Luckey, Ohio. Another west coast consolidation was the purchase of the Union Lime Co. at Williams, Ore., by the Standard Lime and Putty Co., Portland, Ore.

The National Lime, Cement and By Products Corp., of Buffalo, N. Y., are reported as contemplating the erection of a plant at Tuscumbia, Ala.

One sidelight on the lime industry has been the lack of interest in it on the part of bankers and financiers. Conditions, from their point of view apparently, are not favorable for mergers, which have been so much in evidence during 1928 in nearly every other industry.

Oyster-Shell Lime

The plant of the W. D. Hayden Co., Houston, Tex., already referred to, is particularly notable because of the nature of the raw material.

Heretofore the manufacture of lime from shells has only been carried on in a very crude way, and as far as we know this is the first plant of its kind anywhere in the world, and is noteworthy for that reason.

The W. D. Haden Co. owns and operates its own dredges and barges, and the shells used for the manufacture of lime in this plant will be dredged from the Galveston harbor and shipped in barges to the plant at Greens Bayou. There is said to be an unlimited supply of shells that yield a high calcium lime that is excellent for building purposes as well as for chemical uses.

The burning equipment consists of one 7-ft. by 125-ft. Traylor rotary kiln with a 6-ft. by 60-ft. cooler. Natural gas will be used for fuel. Hydrating equipment includes a 1-ton Weber batch-type hydrator, furnished by the designers, Arnold and Weigel, Woodville, Ohio, and the hydrator will have a capacity of from four to six tons per hour. The plant will incorporate all the latest mechanical features, including direct-connected motors to the various units.

The process used for burning shells is in principle similar to that used for burning lime from limestone, but considerable research work was done by the designers before the construction started, and it was found that the production of lime from shells required many differences in technique as to details from that in the ordinary kiln process.

The building housing the kiln and hydrating units of the plant are constructed of concrete and structural steel, with corrugated asbestos sheeting and roofings.

The W. D. Haden Co. has offices in Galveston, Houston, Harrisburg, Beaumont, Port Arthur and Seadrift, and is the largest producer of reef oyster shells in the world. The personnel of the company is as follows: W. D. Haden, president; W. A. Wansley, vice-president and general manager; E. D. Haden, secretary; C. R. Haden, treasurer, and William A. Brunet, engineer.

Incorporations

The following list of new incorporations in the lime industry is probably not complete, but includes practically all of the charters issued of any consequence during 1928:

	Number of Incorporations	Capitalization
California	2	$ 200,000
Delaware*	2	.....
Florida*	1	.....
Georgia	1	50,000
Idaho	1	500,000
Iowa	1	50,000
Maryland*	1	.....
Missouri	1	25,000
New York	1	40,000
Ohio	1	250,000
Oregon	1	300,000
Virginia	3	675,000
Washington	1	50,000
West Virginia	1	50,000
Wisconsin	1	35,000
Total for 1928	19	$2,225,000
Total for 1927	22	1,010,000
Canada	1	19,000

*Incorporation listings, stocks as of no par value. There were four companies filed petitions of voluntary bankruptcy showing total liabilities of $131,903.50 and assets of $15,951.50. Four companies reported out of business during 1928.

Gypsum Products in 1928

Price Cutting and Severe Competitive Conditions Have Disorganized the Industry

THE production of all gypsum products during the past year was slightly above that of 1927, when the gross tonnage figures are considered; but owing to the seriousness of price cutting, rate wars, rebating, etc., on prices (which for the preceding year were anything but satisfactory), the net result for 1928 probably was a decrease as compared with 1927 of roughly $7,000,000 for the gross value of gypsum products, as indicated by figures compiled by ROCK PRODUCTS and from returns on questionnaires, making the estimated value of gypsum sold during 1928 to be $35,000,000. The average price was probably about $6.50 per ton. Our estimate is 5,450,000 tons of crude gypsum used for the current year.

To determine the average value of gypsum products per ton for the years 1920 to 1928 a table was compiled by dividing the total value by the total tonnage of crude produced. This figure, of course, only indicates the trend of gypsum prices, not actual prices. The tabulated figures follow:

GYPSUM PRODUCTION AND AVERAGE PRICES, 1920-1928

Year	Active Plants	Short Tons Mined	Sold Crude		Calcined		Total (crude and calcined) Value	Percent of Total Construction Values That Went for Gypsum Products	Value of All Gypsum Divided by Tonnage of Crude
			Short Tons	Value	Short Tons	Value			
1920	61	3,129,142	669,260	$2,565,195	1,904,484	$21,967,870	$24,533,065	0.68%	$7.82
1921	62	2,890,784	642,944	2,266,011	1,796,851	21,434,279	23,700,290	0.678	8.20
1922	64	3,779,949	770,725	2,443,346	2,491,265	26,917,805	29,361,151	0.60	7.80
1923	62	4,753,448	847,242	2,577,436	3,101,378	32,310,719	34,888,155	0.645	7.35
1924	72	5,042,629	982,108	2,674,320	3,568,569	40,050,187	42,724,507	0.712	8.49
1925	61	5,678,302	1,014,135	2,823,229	4,096,357	44,754,011	47,577,240	0.609	8.40
1926	59	5,635,441	961,363	2,509,885	4,015,974	44,211,334	46,721,219	0.609	8.30
1927	.....	5,346,888	.....	.....	.....	.....	42,174,454	0.55	7.90
1928	.....	5,450,000	.....	.....	.....	.....	35,000,000	0.44 (est.)	6.50 (est.)

Definite estimates of the average cut in prices during 1928 on the basis of 1927 figures were difficult to get, but all of the larger producers interviewed stated that prices were very unsatisfactory, and that profits were very difficult to obtain, and, in most cases, the companies were operating at a loss. Taking the reports as to the amount of price decrease from the reports received, indications are that the cut was approximately 18% for the Eastern part of the country, but on the Pacific coast prices for 1928 were about what they were in 1927, as the price war started there several years ago and apparently still continues, with none of the competing companies eliminated from the contest. The prices of gypsum plaster on the Pacific coast are now given as $7.10 f.o.b. Los Angeles, with sacks extra; San Francisco at $10.40, sacks extra, which is $7.10 f.o.b. north Nevada shipping points and $13.00 in Seattle.

Conditions on the Pacific coast, as summarized by one company, are typical of them all: "Barring the miserable prices we are getting, which are about the same as two years ago, and probably worse in some instances, business has been fairly good this year. We are naturally looking for better prices, but it does not look encouraging yet."

All Aiming to Cut Production Costs

Prices, the operators feel, have gone down as far as they will, and in all probability they will not return to pre-1927 figures for some time. Operating costs at the older plants are so high that it is impossible to make a profit; consequently there is a considerable construction program being carried out by the large producers, so that they will be able to decrease operating costs by these newer, more advantageously located and more economically operated plants.

All of the new plants built or under construction during 1928, with one exception, it is noteworthy, are located near the markets they serve, and are supplied crude gypsum from, in some cases, very distant sources by cheap water transport. This contrasts with the older practice of building the mills at the mine or quarry and shipping the finished products long distances at relatively high freight rates. The economies of this procedure, after a study of the problem, have justified this procedure.

Notable among the producers that are building new plants close to the larger markets is the United States Gypsum Co., which during 1928 started construction of calcining, wallboard and specialty plants at East Chicago, Ind., Detroit, Philadelphia and Boston; and when these plants are completed and operating it will probably mean a complete reorganization of their present operating program, with the possible elimination of those plants which are uneconomical to operate under present conditions.

The plants under construction are all of comparatively large capacity, of the latest design and capable of low production costs. The gross tonnage that can be produced by these new plants when added to the present plant capacities of the United States, will show a considerable increase in potential plant capacities, aggravating conditions still further, unless prices become so low as to eliminate some of these older plants. There is no question that the present unsatisfactory condition of the gypsum industry is due to attempt to use overcapacity, with more overcapacity in sight for the year 1929.

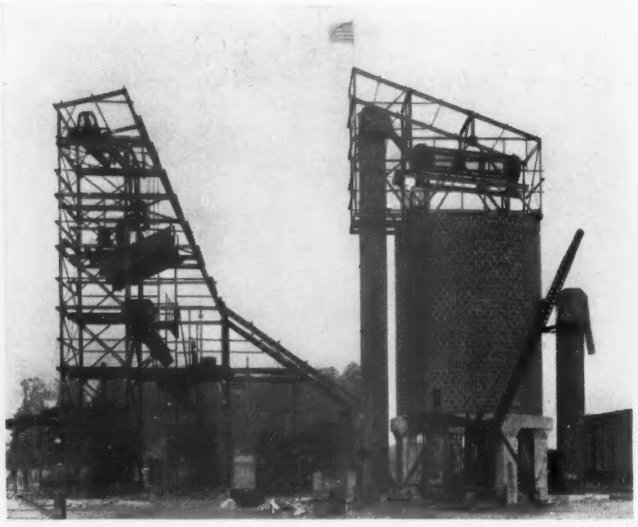
Other companies that have followed a somewhat similar program of getting themselves in a better condition as regards increased capacity are the National Gypsum Co., with a $500,000 plant extension; the Atlantic Gypsum Products Co., with a new plant in New York City, the Ebsary Gypsum Co., the Pennsylvania Gypsum Co., and others.

One new company entered the field during the year on a producing basis, and one new company was reported as building a new gypsum plant. The former is the Victor Plaster Co., Inc., the latter the United States Phosphoric Co., Tampa, Fla.

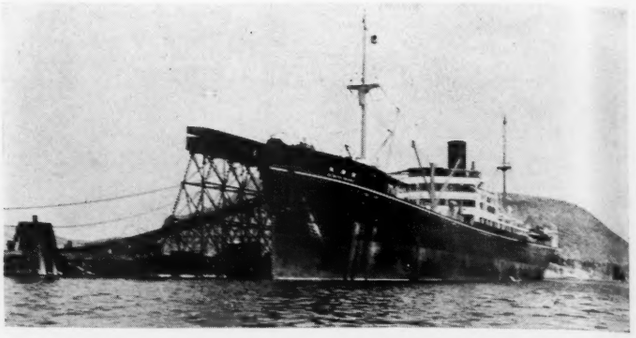
New Plant of Victor Plaster Co., Inc., Ready for Operation

The Victor Plaster Co., Inc., recently completed a new hoist and a modern plant for the crushing of gypsum rock. The plant is located about a mile and a half east of Victor, N. Y., and is on the main line of the Lehigh Valley railroad.

The property consists of 365 acres, of which 250 acres have been tested, first by core drilling in various locations on this acreage, and second, by sinking a



The new hoist and crushing plant of the Victor Plaster Co.



Loading crude rock for export at San Marcos Island, Gulf of Lower California

shaft 15 ft. by 15 ft. to a depth of 110 ft. At the bottom of the shaft was found a bed of high grade gypsum 6 to 6½ ft. thick and approximating 4,570,000 tons, with a recoverable tonnage of not less than 3,800,000 tons, or about 15,000 tons per acre. No anhydrite has been found in any of the test holes. The core drilling and the shaft disclosed several other beds of commercial gypsum estimated at 15,000,000 to 20,000,000 tons, constituting a valuable rock reserve for the manufacture of gypsum products.

The plant was designed for a capacity of 600 tons of crushed gypsum per 10-hour day. Construction started about April 15 and the plant has just been completed. Electric power is supplied by the Rochester Gas and Electric Corp.

All buildings and heavy machinery have concrete foundations and the buildings are all of steel structure throughout, the outside covering consisting of asbestos protected metal.

Mining has been started north and south from the original shaft, pillars being left on east and west sides. The shaft is four-compartment, having two cage compartments, air ventilator and stairway. Drilling is done by means of electrically driven rotary auger drills. The rock is loaded into low-side steel cars of a capacity of about 2 tons each.

These cars are 36-in. gage and are pushed on tracks to the automatic self-dumping cages, and from here are hoisted by a 50-hp. engine, and dumped into a hopper above, which is provided with a hopper suspension scale equipped with a card punching attachment, made by the Standard Scale and Supply Co. Here the rock is weighed and delivered into a slow moving apron conveyor which feeds it into a single-roll Pennsylvania crusher, driven by a 75-hp. motor. The crusher has a capacity of 60 tons per hour of gypsum rock, crushing to 1½-in. and under.

From the crusher the rock is elevated by means of a bucket elevator driven by a 20-hp. motor, to a rotary screen 48 in. by 14 ft., above a silo. The oversize pieces are returned by a tailings return belt to the crusher. From the silo the rock is fed through a chute to a Schaffer poidometer, that automatically weighs and delivers the rock, after which the material passes to a car-loading elevator that is driven by a 5-hp. motor. It can then be readily spouted into the freight car. Cutler-Hammer push-button control is used throughout the plant.

Texas Project

The Tidewater Gypsum Co., at Houston, Tex., reports that its property, located on the Hockley Salt Dome, 31 miles from Houston, has been developed by deep-well borings and by the sinking of a 7 ft. by 14 ft. vertical shaft to a depth of 200 ft., having penetrated 100 ft. of solid gypsum and encountered no water. This deposit is unique, as the gypsum is overlaid with valuable strata of marble, and it is the intention to develop both the gypsum and marble for the Southern market.

New Byproduct Gypsum

The Aluminum Ore Co., East St. Louis, Ill., entered the gypsum plaster field in a small way, having developed a method of converting a residue, which is essentially anhydrous calcium sulphate, or synthetic anhydrite containing some free H_2SO_4, hydrofluoric acid and traces of fluorspar, to gypsum, and when calcined makes a stucco capable of producing an unusually hard wall. The waste product is a residue resulting from the manufacture of hydrofluoric acid from fluorspar.

The process includes a method of hydrating the anhydrous calcium sulphate to gypsum, filtering the hydrated material, and calcining the filter cake in standard kettles.

The company has only a limited supply of this material available—roughly 50 tons per day—and it is the intention to seek a local outlet.

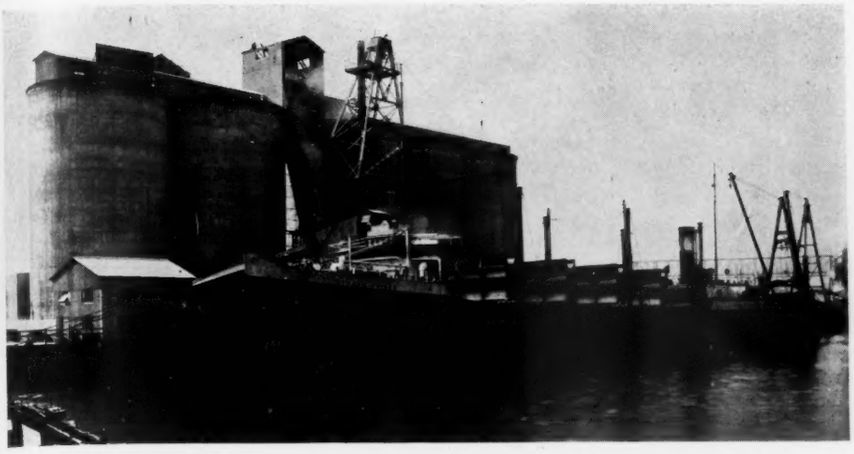
The impressive feature of this plant is that the research staff of the company, under the direction of G. H. Wagner, research chemist, and R. F. Rucker, superintendent, have produced something of economic value from a waste product.

Consolidations

The most notable consolidation was that of the Certain-teed Products Corp. and the Beaver Products Corp. in a $47,000,000 merger. This merger was opposed by the United States Gypsum Co. on the grounds that the acquisition of the assets of the Beaver companies by the Certain-teed Products Corp. would leave the former without assets to carry out the provisions of its licensing contract, but the merger was eventually consummated on a basis supposed to be satisfactory to both.

The Universal Gypsum Co., Chicago, Ill., acquired the plaster mill and 270 acres of gypsum ground formerly owned by the Higginson Manufacturing Co., Newburgh, N. Y., and an interest in the lime plant of that company at Ossining, N. Y. The National Gypsum Co., Buffalo, N. Y., entered the lime business by taking over the plant and business of the Luckey Lime and Supply Co., Luckey, Ohio. The Atlantic Gypsum Products Co. and the Canada Cement Co. combined their Canadian gypsum operations, whereby the Atlantic Gypsum Products Co. will take over all the gypsum operations of the Canada Cement Co., including the plant of the Pennsylvania Gypsum Co., Chester, Penn., near Philadelphia. The Atlantic Gypsum Products Co. will supply the Canada Cement Co. with all the gypsum required for its portland cement.

The United States Gypsum Co. purchased the Heath, Mont., plant of the Northwest Gypsum Products Co. and the Casper plant of the Overland Cement Plaster Co. at Casper, Wyo. The Certain-teed Products Corp. also acquired a gypsum deposit in Colorado. The old Beaver Products Corp. plant at Acme, Texas, taken over by the Certain-teed



Unloading gypsum at United States Gypsum Co. plant, Boston, Mass.

Products Corp., was closed April 1, 1928.

A development of importance during 1928 was the liquidation of the retail establishments of the United States Gypsum Co. at Hartford, Conn., Boston, Mass., and Buffalo, N. Y. These disposals mark the final chapters of that company as a retail concern.

Tariff on Gypsum

Acting for Southern and Eastern producers of gypsum, early in 1928, attorneys in New York brought proceedings before the United States Treasury Department to classify the importations of gypsum, which was entering as crude and therefore duty free, as ground gypsum and therefore subject to a duty of $1.40 per ton. On June 12, 1928, the Treasury Department ruled that it was the intention of Congress to assess materials of this class as implied and therefore declared that gypsum imported into the United States was subject to this tariff. This announcement received so many protests that the Department held a hearing at the Bureau of Customs on July 20 and testimony was submitted by importers. On October 20 the Treasury Department announced that it had decided to apply a duty of 30% ad valorem upon imports of crushed gypsum, which rate is provided by Paragraph 214 of the Tariff Act of 1922. The full text of this decision was published in Rock Products, October 27, 1928.

Briefly, this ruling was based upon the theory that the crushing process in Canada was one step in the ultimate manufacture of the gypsum and that the crushing dispensed with at least one operation in this country.

Importers have challenged the correctness of the basis upon which the Department's decision was reached, and an investigation is now taking place for the purpose of determining whether or not the crushing of the gypsum is in fact one step in the manufacture of gypsum products.

The outcome of this important decision is awaited with extreme interest, as it affects several of the largest producers, among which are the United States Gypsum Co. and the Atlantic Gypsum Co. in the East, and the Standard Gypsum Co. on the Pacific coast. The imports from all sources amounted to 824,081 tons in 1926 and 828,619 tons in 1927, and it is expected the 1928 figures will be very close to a million tons, or roughly one-fifth of the total tonnage consumed in the United States this year.

Shipment by water of the run-of-mine gypsum, without preliminary crushing, in the opinion of several gypsum engineers, does not appear to offer a method of evading this tax, as methods of boat loading and unloading would have to be changed, and they are doubtful as to the saving by this alternative.

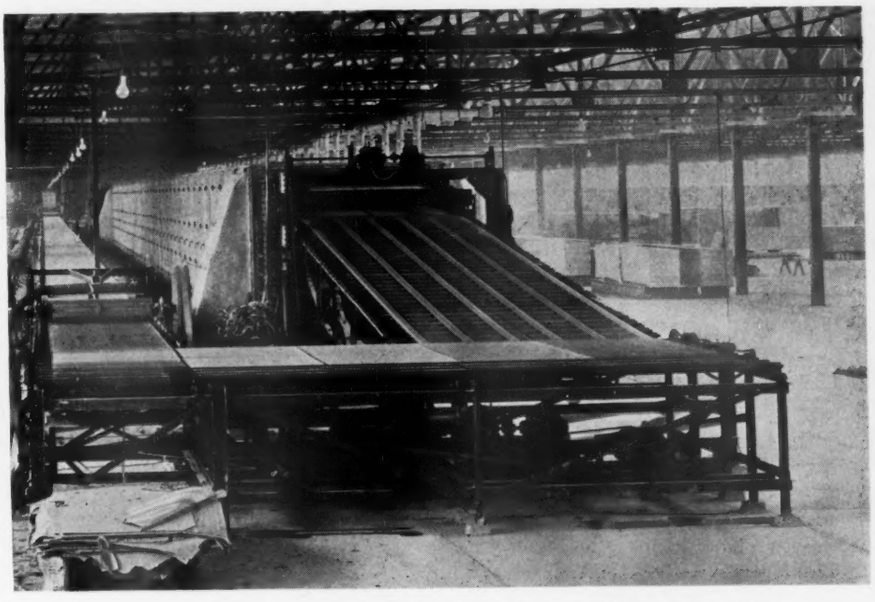
Patent Infringement Suits

The United States Gypsum Co., owners of the so-called Utzman patents and Gustafson patent No. 1,665,168, are pressing suits against several of the gypsum wall-board producers. That company at present is suing the National Gypsum Co. for infringement on the Gustafson patent, and during this year a decision has been made upholding one of the United States Gypsum Co.'s patents against the American Gypsum Co., of Port Clinton, Ohio. This suit involved the infringement of the Birdsey patent No. 1,358,508, on a certain type of wallboard edge.

General Developments

The Atlantic Gypsum Products Co. completed its New York plant during 1928. This plant occupies the same site as the old plant destroyed by fire early in September of last year. The new plant has a capacity of 850 tons per day. The plant is equipped with three kettles, a Pennsylvania hammer mill, four especially equipped Raymond mills and Fuller-Kinyon pumps. The motors were furnished by Fairbanks-Morse, with Allen-Bradley control equipment. Dust collectors are W. W. Sly Manufacturing Co. and Dust Recovering and Conveying Co. Brown indicating thermometers and CO_2 recording instruments are used to control operations, and the automatic kettle and dust-arrester control apparatus was supplied by Schaeffer and Budenburg and the C. J. Tagliabue Manufacturing Co. The design was from the office of H. J. Brown, consulting engineer, Boston, Mass., who designed the company's plant at Portsmouth, N. H.

The United States Gypsum Co.'s new Boston plant started operating with the arrival of the first shipload of gypsum rock on November 14. This plant was briefly described in the September 29 issue of Rock Products. The raw ma-



Wet wallboard entering dryer at new plant of Ebsary Gypsum Co.

terial storage consists of a battery of five concrete silos, 86 ft. high, built along the waterfront. A wooden wharf outside the silos carries a traveling unloader which discharges to a belt conveyor. This belt discharges in a small building at the end of the wharf, and delivers to an elevator installed between silos Nos. 2 and 3. The elevator discharges to a conveyor running across the tops of the silos.

This unloading and conveying equipment, all of special design, operated with marked efficiency during its first workout. Raw material will continue to be brought in until the storage capacity is filled, at which time the manufacturing units of the plant will be ready to operate, probably about March 1. Construction is progressing rapidly on the various buildings of the plant, and erection of machinery is closely following. This construction, including the erection of all machinery and equipment, is under the management of the Morton C. Tuttle Co., of Boston, as is also the construction of the new plants for the same company at Philadelphia, Penn., and Detroit, Mich.

Rock for the new plants of this company will be transported in the *Gypsum King, Gypsum Queen, Gypsum Prince,* and the later addition to the fleet, the *Gypsum Princess,* all specially designed and built for handling gypsum cargos. The latter boat is 347 ft. long, with a 52-ft. beam, with a gross tonnage of 4400 tons. She was built at the Furness Shipbuilding Co., Ltd., of Hoverton, Hull-on-Lee, England.

Another new plant of the United States Gypsum Co., at Midland, Calif., started operating during this year. This is only a calcining plant and probably is intended to make all the company's shipments to southern California markets, and the Arden, Nev., plant very likely will be abandoned. Plans for the erection of a wall-board plant at Midland are said to be undecided. The Arden plant was responsible for a fair portion of the Nevada tonnage which from July 1, 1927, to July 1, 1928, amounted to 220,437 tons.

Best Bros. Keene's Cement Co., Medicine Lodge, Kan., is reported to have made additions and enlargements to the plant.

Plants Under Construction and Enlargements

The outstanding plants now under construction are headed by the four new plants of the United States Gypsum Co. at Boston, Detroit, Philadelphia and East Chicago, Ind. The total investment for these plants will be between $10,000,000 and $12,500,000.

The Ebsary Gypsum Co., Wheatland, N. Y., placed in operation their new wall-board plant, in which is installed perhaps the most modern dryer that is now in the industry. This dryer was supplied by the Coe Manufacturing Co., of Painesville, Ohio.

The National Gypsum Co. installed a new hammer mill and other additions to its National City (Mich.) mill.

The Pennsylvania Gypsum Co., before its acquisition by the Atlantic Gypsum Products Co., authorized the expenditure of $200,000 for alterations and improvements to the Chester, Penn., plant.

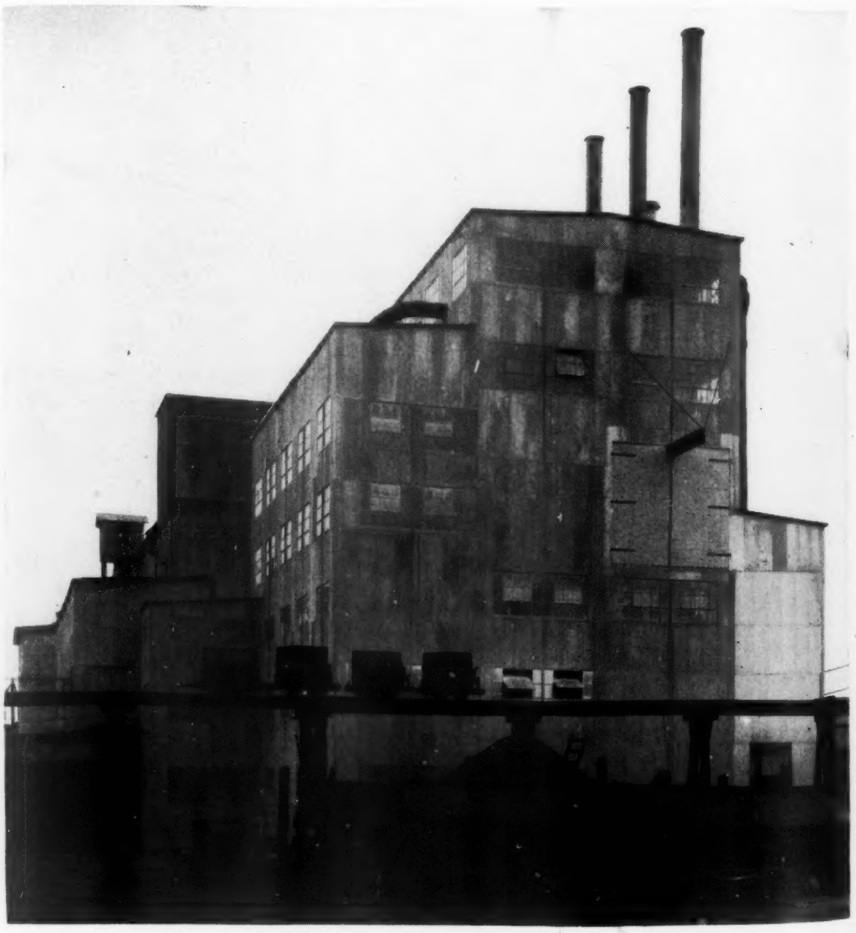
The Schumacher Wall-board Co., a subsidiary of the Paraffine Co., completed a new wall-board plant in Los Angeles, investing, it is said, close to $500,000 in this addition. This company also consolidated with the Western Wallboard Co. of Seattle, forming the Gypsum Products, Inc., and will manufacture wallboard at the Seattle plant for Northwest markets and for shipment to Japanase points.

The Standard Gypsum Co. made some changes in its Long Beach, Calif., plant, installing a Pennsylvania hammer mill for a secondary crusher, and also installing at San Marcos Island, Lower California, a new 365-hp. Busch-Sulzer Diesel engine, direct-connected to a 300-kw. General Electric generator. This installation will insure the company ample power for all the quarry and loading operations. This company also made considerable shipments of crude rock to Japan from the San Marcos deposits, and to insure an ample supply of crude rock for quick loading of the boats the stockpile capacity was increased to 20,000 tons. This represents an increase of about 4,000 tons live capacity.

At Alabaster, Mich., the United States Gypsum Co. completed an aerial tramway 1¼ miles long from the shore line out into the lake. This tram was built as part of the loading equipment to be used for loading crude gypsum for water transportation to the new Detroit and East Chicago plants.

New Products

There were very few new gypsum products outside of those developed by the United States Gypsum Co. Among these new products are: waterproof cold water paint, "Texolite"; "Em-Bel-Lo" is a plaster paint suitable as a color carrier or texture base. This company also developed a method of sound-proofing between rooms or from any adjacent



This plant of the Atlanta Gypsum Products Co., New York, was completed during 1928

source. This is essentially a method of construction which interposes a "shock absorbing" medium between the finished surfaces. The material is in the nature of a porous furring and is supplied for ceiling, wall, sub-ceiling or floor insulation purposes. This company also added a full line of metal lath to its already wide line of plastering materials.

The Rockwood Lumber Co., of St. Louis, Mo., has developed and placed on the market a gypsum lumber which consists primarily of a 4-in. by 12-in. hollow, tongue and grooved member that can be manufactured in lengths up to 27 ft. and can be used for bearing and non-bearing partitions, according to prepared specifications. This company's interesting operation and construction methods will be described in a later issue of ROCK PRODUCTS. Its gypsum floor tile is also of new and novel design.

The introduction of the "talkies" in the moving picture industry has led to the development of a new and interesting use for gypsum as an insulator of sound and at one installation in Hollywood, Calif., the Fox Movietone Co., there is a plant which represents an investment of $10,000,000 and comprises 17 buildings of reinforced concrete, two of which include the huge buildings housing the sound-proof stages. The sound-proof stages are the most interesting part of the project. Two gigantic concrete shells anchored some 20 ft. underground each house two sound-proof stages. The stages are each 100 ft. long, 75 ft. wide and 30 ft. in height, and may be likened to huge concrete boxes. They are separated from the outerbuildings by a dead air space. The sides of the concrete walls facing the air spaces are lined with a layer of cork and a layer of felt.

The feature which contributes most to the great silence which will reign within the stages is the hanging walls and ceiling. The stages are literally hung from the roof to the floor level by means of steel rods suspended vertically. The same system is employed for the ceiling, but here gypsum slabs are used.

The gypsum slabs, which are 30 in. square and about 3 in. thick, are built on a foundation of expanded metal and have steel rods running through them ending in hooks at the sides. Suspended horizontally on heavy wires from the roof trusses and joists are channel irons which run the full width of the stages at intervals corresponding to the width of the gypsum blocks. The slabs are hung on these channel irons and the interstices are filled with gypsum from above and plaster from below. The under surface is covered with felt and cork.

The ceiling of each stage requires approximately 62½ tons of the gypsum slabs. The four stages call for the use of 30,000 sq. ft. of this material with a total weight of 250 tons.

Gypsum lumber was a 1928 development

So well insulated are the stages from outside vibration that it is estimated an airplane with engine wide open might fly over the roof and within ten feet of it and the roar of the motor would cause no vibration or sound inside the structure.

Technical Developments

Several of the newer plants, especially those of the United States Gypsum Co., are using rotary kilns for calcination, which is quite significant. However, the extended use of pressed steel bottoms, which have eliminated excessive repairs to the older cast bottoms, has given the older kettle calcination process a grip that will be difficult to overcome, especially in plants of small capacity or with moderate working capital.

Noteworthy have been the advances made in dust collection in connection with calcination processes, developments that have made it possible to operate calcining plants in the larger cities. This phase of plant operation has in several instances caused some difficulty in securing building permits. Dust collection from other places in the mill presents no special problem. At the kettles several methods have been developed; one by William Senseman of Los Angeles, who is connected with the Raymond Bros. Impact Pulverizer Co., the W. W. Sly Manufacturing Co., and the Dust Recovering and Conveying Co. All of these methods seem to give satisfactory results.

Rotary crushers for gypsum are apparently being superseded by the hammer mills, judging from the new plants installing this equipment, and where plants are replacing the former type with the hammer mills. This latter mill, according to one operator, gives a very satisfactory feed material for Raymond mills and has corrected somewhat the troubles at the mills due to tramp iron.

Fuller-Kinyon pumps continue to gain favor in the handling of both hot and cold stuccos. At the Schumacher plant in Los Angeles they are successfully handling comparatively cold stuccos, and the newer plants are incorporating this feature in their designs.

Buhr mills have been in general use in past year for grinding calcined gypsum. Owing, however, to the power required, maintenance cost and the large number of units necessary for a plant of any considerable capacity, this type of mill has been replaced in a number of gypsum plants by tube mills of the Hardinge type.

A new method of calcining gypsum is now being developed by the Raymond Bros. Impact Pulverizer Co., and is a step farther in the application of their mills for grinding and drying in the same operation. It has been common practice to combine drying and grinding of rock products which are physically water-wet in these mills, but the removal of chemically combined water, and grinding in the same operation, is new and novel. So far the results have been very satisfactory in an experimental plant and stucco of exceptional uniformity has been produced.

The process consists essentially of pulverizing gypsum, the mill being surrounded with a suitable firebox which is heated by oil, gas or powdered coal fuels. The grinding operation and calcination are thus conducted simultaneously, and the calcined stucco is removed from the mill by the usual Raymond mill fan and air-separation system. The bearings of this mill are water or oil cooled and extend outside the firebox.

The results obtained on a small mill that produces 1500 lb. per hour are so satisfactory that the Raymond Bros. company is ready to coöperate with any gypsum stucco producers to work out the process on a larger scale. W. C. Riddell, chief engineer of the Standard Gypsum Co., is at present assisting the engineers of Raymond Bros. in perfecting the process.

Owing to the low installation cost and simplicity of this process, its commercial development might mean that many small products manufacturers who now purchase their stucco might seriously consider calcining their own material provided crude gypsum were easily obtained.

From returns on our questionnaires 70% of the plaster sacked for shipment was in jute or cloth sacks, and 30% in paper, with several producers shipping as much as 40% in bulk.

Patent Reviews and Publications

In the March 3, 1928, issue of Rock Products appeared a summary of the patents relating to wallboard, by Joseph Rossman. In the January 21, 1928, issue appeared a comprehensive outline of experimental work on the expansion of gypsum by J. A. Murray. Two articles by Otto Fr. Honus on "The Technology of Gypsum Plaster Materials" were published February 18 and April 28. The series of articles by Walter B. Lenhart, now an associate editor of Rock Products on "The Manufacture of Gypsum" were concluded during 1928.

Canadian Notes

Two of the Canadian plants of the Canada Gypsum and Alabastine Co. were described during 1928, and a description of the Winnipeg plant is to be published soon.

During March, 1928, the Canada Gypsum and Alabastine Co. combined with the Manitoba Gypsum Co. This merger and that of the Atlantic Gypsum Products Co., taking over the gypsum operations of the Canada Cement Co., were the two outstanding developments in Canada during 1928.

Gypsum Institute Succeeds Gypsum Industries, Inc.

One of the changes during the past year in the gypsum industries was the organization of the Gypsum Institute which succeeded The Gypsum Industries, Inc.

Owing to the unsatisfactory condition of the gypsum industry for some time past, the old organization known as The Gypsum Industries, Inc., suspended operations on May 1, 1928. Certain gypsum manufacturers, recognizing the need of cooperation and the continuation of an association of some kind, met in Buffalo, N. Y., on June 15, and Chicago, Ill., on June 16, 1928, and reorganized, for the time being, The Gypsum Industries, Inc., and at a meeting in New York City on August 2, decided to continue an association and organized the Gypsum Institute which takes the place of the old association.

The Gypsum Institute is functioning in practically the same manner as the old association and headquarter offices and a traffic department were opened at 110 West 40th Street, New York City, on July 17, 1928. The officers of the Institute are as follows: President, James Leenhouts, vice-president and general manager, Grand Rapids Plaster Co., Grand Rapids, Mich.; first vice-president, Eugene Holland, president, Universal Gypsum & Lime Co., Chicago, Ill.; second vice-president, L. I. Neale, sales manager, Atlantic Gypsum Products Co., New York City; secretary and treasurer, W. J. Fitzgerald, 110 West 40th Street, New York City. Other members of the board of directors are: F. G. Ebsary, president, Ebsary Gypsum Co., Scottsville, N. Y., and J. F. Haggerty, president, National Gypsum Co., Buffalo, N. Y.

The members of the Gypsum Institute are: American Gypsum Co., National Gypsum Co., Atlantic Gypsum Products Co., Niagara Gypsum Co., Ebsary Gypsum Co., Empire Gypsum Co., Grand Rapids Plaster Co., Oakfield Gypsum Products Corp., Universal Gypsum & Lime Co., and Structural Gypsum Corp.

A research associate is maintained at the Bureau of Standards at Washington, D. C., in connection with research work on gypsum products. Also, in order that engineering and other important matters referring to gypsum products may receive the proper attention, a technical problems committee was appointed at the meeting of the Gypsum Institute held in New York City, on December 18.

One of the outstanding features of the work of the present Gypsum Institute is the traffic department. A complete traffic bureau is maintained and this department furnishes services to the members of the Gypsum Institute in the quotation of freight rates, the furnishing of rate schedules and publishing freight rates from all producing points to points of destination in the various states of the United States.

Also, meetings of traffic representatives of gypsum manufacturers are held and the secretary of the Gypsum Institute acts as chairman and issues calls for all the meetings and distributes a docket of the subjects to be discussed at these meetings. Nonmember gypsum manufacturers as well as members are present at these meetings. As a result of these traffic meetings, the important work resulting during the year was in connection with the Upson case, Interstate Commerce Commission Docket 17006, and the increase proposed by the carriers in the rates on plasterboard in Southern territory, on which application for suspension was made by the gypsum manufacturers to the Interstate Commerce Commission and which was granted, and upon which a hearing was held in Washington, D. C., October 10, 1928.

Diatomaceous Earth

THE PRODUCTION of diatomaceous materials for 1927 is not available, as the Bureau of Mines is not at liberty to publish the figures. The reason for this is probably due to the fact that one company can account for practically the entire tonnage. This company, the Celite Products Co., with plants and quarries at White Hills, Calif., near Lompoc, was recently taken over by the Johns-Manville Corp.

Diatomaceous materials as sold by that company are more familiarly known to the rock products industry under the trade names of "Celite," "Sil-O-Cel," etc., and find extensive use as an admixture in concrete and as insulating and filter materials.

Other deposits of this material are in Nevada, but are not being developed at present. Deposits in Nova Scotia are controlled by the Scotia Diatom Products, Ltd., Little River, N. S., and that company expects to spend $225,000 on development work in the near future.

The last available figures showing the production of diatomaceous earths are reported as follows:

Year	Tons	Value	Value per ton
1923	65,833	$ 699,406	$10.52
1924	63,163	693,917	10.97
1925	73,030	922,281	12.61
1926	87,126	1,081,564	12.40

No statistics gathered since 1926.

Enameled Sand-Lime Brick

ARTIFICIAL COLORING of sand-lime brick has been attempted by several methods, one of which is by covering the exposed edge of the brick with a paint or enamel. The bureau recently tested the weathering qualities of brick enameled on one edge with a cellulose type enamel. The results, while unfavorable to the particular specimens tested, nevertheless may be of general interest.

The enamel was applied in an extremely thin coat to the surface of the brick. It did not hide the textural character of the surface. The brick as received were mainly cream-colored enameled, although a few specimens with a white enamel were obtained.

It was found that the enamel softened and discolored on immersion in hot water or on dry heating at 110 deg. C. Freezing and thawing tests of the brick were made. In all cases the enamel cracked or chipped in less than 30 alternations. Specimens exposed to the weather during July and August, when compared with unexposed specimens, showed appreciable color changes. The white enamel had turned to a yellowish cream, while the cream had bleached to a much lighter color.

The results indicated that this type of finish was unsatisfactory both as to permanence of color and finish. In the development of any coloring process for sand-lime brick the strongly alkaline nature of the brick must be considered.—*Technical News Bulletin.*

Opportunities for Using Indicating and Recording Control Instruments in Our Rock Products Industries

Crudeness of Raw Materials Not a Mark of Backwardness in Engineering Development

By James R. Withrow
Head of the Chemical Engineering Department, the Ohio State University

QUITE NATURALLY, the academic, theoretical point of view draws the conclusion that our rock products industries are very crude and far behind the times in instrumentation. Rock raw materials are raw and crude indeed. One only needs to name the outstanding ones: limestone, trap-rock, sandstone, granite, sand and gravel, phosphate rock, gypsum, slate, talc, soapstone, and glass sand. Few if any of them are of much use without some form of engineering or chemical manipulation. In some cases this manipulation is simple and direct, incapable of much if any variation, with results a matter entirely of design of equipment, with little or no operation variable except the time factor.

The elementary or fundamental chemical engineering operations utilized by some of our rock products industries which belong in this class of direct-action, non-fluctuating activities, and therefore rarely instrumented engineering operations, are: Quarrying; Transporting; Crushing; Grinding; Washing; Screening; Sizing; Storage.

Future of Instrumentation in Crude Elaboration of Rock Products

These operations are usually variable as to time-rate or speed only, and seldom automatically or unexpectedly vary in either quantity or quality of product. The urge for instrumentation is therefore not pressing.

This does not mean that instrumentation could not improve any or all of these engineering operations. It could. It does. It should be used on many large operations where it is now missing. This is almost an untilled field, by instrument makers and by producers. It is a difficult but important one. Producers are naturally skeptical and do not yet take this view.

The most up-to-date and most highly developed engineering equipment covering the engineering operations mentioned for the crude elaboration of rock products would not necessarily involve any instrumentation whatever.

The moment we go beyond the direct-action, engineering operations of the crude elaboration of rock products and produce chemical changes in the products so as to obtain new chemical substances, with accompanying new properties demanded by engineering and industry, the whole situation is quite a different one. Here, for the first time, method of operation produces differences in both quantity and quality of product. The method of applying heat in a lime kiln is well known to affect these factors, and the same thing is true in the calcination or furnacing of cement clinker, and even the heating of gypsum for the manufacture of plaster is profoundly affected by the method, kind and quantity of heat application.

Introduction

ADVANTAGE has been taken for a long time of the opportunities for using control instruments in our rock products industries. Many cement, gypsum and lime plants use instrumental control of one form or another. This article is the introduction to a series of articles to be published by ROCK PRODUCTS in 1929, which is the result of a thorough investigation of how better utilization of control instruments may be made in all these industries.

—The Editor.

Calcination or Furnacing Operations in Our Rock Products Industries

The mere fact that the products of this advanced or special or chemical engineering manipulation or processing are new chemical substances which cannot be evaluated by the eye, makes more intelligent checking or control of the furnacing operation necessary.

More skilled workers are therefore required. The skilled lime burner, the skilled kiln operator in the cement plant, or the skilled gypsum calciner have long since developed a technique of telling with the eye just how far along in the process they have carried the material, in view of reasonable constancy of raw materials, equipment, operation, time and the like.

The very temperature of the source of heat itself and the type of the equipment have profound effects on both quantity and quality of the product in all of these industries.

In other words, with a given design of kiln or furnace and a given rate of through-put, if the source of heat should cool below a certain permissible limit to be found only by experience, the cure is reduction of through-put. For instance, in a rotary kiln for lime or cement, by ceasing revolution of the kiln and every ten minutes giving it a quarter or complete turn until the heat input has reached the proper rate, or the heating zone has reached the proper temperature, whereupon operation may be resumed. If the temperature in such a device should get too hot, then the speed of the kiln may be increased so as to produce greater through-put, thereby cooling down the kiln. This is all postulated upon the usual assumption in an operating plant that the neck of the bottle is the heat which can be produced by operating the input of fuel at the maximum of the producers, or the powdered coal feed.

Opportunities for Instrumentation in Calcination Rock Products Industries

Obviously, even this type of plant can operate through the experience of skilled operators, and some of the most recently constructed cement plants in the country are operating with no instrumentation whatever, or apparently no one on the ground who has ever used pyrometric equipment.

However, most plants have long ago adopted recording devices to assist the skilled operators on the one hand, and maintain a record on the other hand, which can be studied later if any wrong condition develops. Some furnacing industries would never dream of failing to maintain a complete and extensive record of all variables which enter into furnacing operations, such as temperature at vital or strategic points, feed of producers, rotation of kiln, temperature of exhaust gases to stack, and the like. If the product ever develops an unsatisfactory status, such records are of inestimable value in getting back to normal operation.

In view, however, of the unusually wide zone of temperature fluctuation without unexpected or easily detectable variations in quality of product, in some cases not much reliance is placed upon instrumentation. The fact always remains, however, that an un-

biased office record also constitutes the best defense of the skilled operators when something does go wrong, and the question is raised, "What did you change in the kiln operation?" The opportunities, therefore, for using instruments in our rock products industries, where furnacing or calcination is the major tool, are numerous and of increased importance.

The greatest reason, perhaps, for the use of instruments is the fact that operators can use more skill in their art with graphic records constantly before them, and this will usually lead to a better product. A goal is set up by these records in which any healthy worker is interested. It enables him to detect quickly any accidental changes tending to cool off his furnace. The instruments serve as watch-dogs, constantly alert to prevent needless waste. They are ceaseless drivers which give no offense to the men. They proclaim errors in faulty operation and protect the outgoing shift against carelessness in their successors, and the incoming shift against failure to complete the job on the previous shift. They lead the way to a better product, as well as more efficient operation, and promote friendly competition between crews and shifts and individual workers. The job becomes a game.

The presence of instruments is a sign of good management, and few plants where chemical changes take place, as in the furnacing industries, are without them. Instruments, however, are not a substitute for common sense or intelligence in either workmen or management. Their absence is not a sign of bad management, but may be a sign that too much depends upon individuals in management.

At any rate, the phenomenal growth of instrumentation in the industries in general is sufficiently reflected in the rock products industries, difficult as it is to apply instrumentation in many of them with any degree of satisfaction, that one can truthfully say that on the whole the rock products industries are far from being behind the times in this matter.

There are places in the rock products industries where we should have better instrumention. There are places in the rock products industries where instrumentation has done little good. These growing pains and experiences are valuable to the industry as a whole.

The Field of Instrumentation in Our Rock Products Industries

In spite of the optimistic statements just made, this field lies pretty close to the border where genuine doubt arises as to the desirability of instrumentation, and the conclusions of no one on the subject should be spared in criticism, for every plant constitutes its own problem which the management must closely study in the matter of instrumentation.

A survey of the feasibility of instrumentation in the calcination end of our rock products industries will furnish meat for debate in the minds of management, and will, therefore, stimulate action which will be helpful in many cases.

It is therefore felt that the following program will be of interest:

ROCK PRODUCTS proposes to publish a series of provocative articles as rapidly as they can be prepared, beginning some time in January, 1929, on the general subject of *TEMPERATURE MEASUREMENT, RECORDING AND CONTROL DEVICES.*

The field to be covered in these articles will take approximately the shape of the following outline:

I. Great strides in industry with the help of instrumentation.
II. Present status in cement, gypsum and lime industries.
III. Fundamentals of pyrometry and instruments available.
IV. The cement industry.
V. The gypsum industry.
VI. The lime industry.
VII. Future in the furnacing industry.
VIII. CO_2 recording — Fundamentals and instruments.
IX. CO_2 recording — Cement, gypsum and lime industries.

The major emphasis will be placed in these articles upon a simple and plain discussion of the fundamentals of temperature measurement and pyrometry and the instruments available in industry for this purpose.

Feldspar in 1928

THE FELDSPAR INDUSTRY apparently needs a parent organization or national association to handle some of the problems that are just beginning to press the producers. A standardization of the different grades, the need of a protective tariff, closer co-operation among grinders and producers and development of new uses for feldspar are some of the problems that could and should be handled by a national association. The necessity for an organization of this kind is felt by the producers and in reply to our question as to what was the greatest problem in the feldspar industry as a whole, 60% of the replies expressed the need of a national association of some sort.

Judging from the reports received from producers, the tonnage of feldspar produced during 1928 will be very close to that of 1927, which was considered a very good year from a tonnage standpoint. The selling price apparently was the same as for 1927.

The indications are that the producing capacities for 1929 will be 20% larger than for 1928, as one large producer expects to build a new plant in North Carolina and several are planning on additional plant and quarry equipment Competition from foreign sources did not increase according to reports.

The following table shows the production and value for the years indicated:

Year	Long tons	Value	Value per ton
1924.....	204,772	$1,509,339	$7.51
1925.....	185,706	1,315,654	7.08
1926.....	209,989	1,607,101	8.00
1927.....	202,497	1,424,755	7.10

The imports of crude feldspar in 1927 was 27,424 long tons valued at $206,856.

There were 29 operators running 31 mills in 13 states, according to the latest reports. Of these producers roughly 88% were grinding domestic rock and the balance on Canadian feldspar.

Practically all the feldspar consumed industrially is prepared by fine grinding, and even for all uses it is crushed to small sizes and graded by screening, etc. The price received for the ground feldspar from domestic crude range from $12.00 to $22.00 per ton.

The principal uses of feldspar are as a flux in pottery glass, enameling industries, abrasives in soaps, binders, fillers, poultry grits and for roofing granules and pebble dash.

New Developments

One of the most modern feldspar grinding plants in the United States is that of Golding Sons Co., at Trenton, N. J. This plant was described in detail in the September 1 issue of ROCK PRODUCTS.

The plant is unusual in many respects, especially in the feldspar industry, as it uses poidometers for proportioning the various kinds of feldspar into any required mix.

The North Carolina Feldspar Co. during 1928 let a contract for the erection of a grinding plant to be built at Bowditch, Yancey County, and when completed will have a capacity of 100 tons per day. The Feldspar Milling Co., Inc., Burnsville, N. C., incorporated for $500,000 and are reported to be building a plant to grind 75 tons per day. In the Virginia district, the Clinchfield Sand and Feldspar Corp., Brookneal, Va., will soon have their new plant in operation. In Minnesota, near Warroad, feldspar deposits of considerable magnitude are being explored by shafts and diamond drilling and from reports received and published from time to time will be a producer during the next year.

The Eureka Flint and Spar Co., Trenton, N. J., is reported to be installing a grinding plant. The Patapso Power, Light and Mineral Co., Marriotsville, Ind., was incorporated for $100,000 and is reported to be preparing to grind feldspar. The American Feldspar Co., Toughkenamon, Penn., is reported rebuilding its plant which was destroyed by fire.

Silica Sand Industry Shows Considerable Activity in 1928

Consolidations in the Ottawa District and Construction of Several Plants Are Features of the Year

IN A YEAR that has been marked by considerable activity in the silica sand industry in general, the outstanding feature of the development has been the mergers of smaller companies into large operating units. What the eventual effect will be on the industry as a whole cannot, of course, be foretold, but it would appear likely that there will be a stabilizing effect, which, unfortunately, has been lacking in the trade in some years past. No change has been felt in the industry as yet, but it is certain that 1929 will see some marked effects from the 1928 changes.

As a whole the silica sand industry had probably a slightly better year than in 1927. Although a number of the old plants report a radical reduction in their output, the total production will probably exceed the 1927 output, due largely to several new plants having commenced operations during the year. Reports of prices from the widely scattered producing districts indicate that for the most part the prices have remained about as they were a year ago. Production in 1927 was about 8,500,000 tons and indications are that this year's output will exceed this by 5%.

Speaking of the condition of the industry in general, one manufacturer of machinery for silica sand plants, states, "We are inclined to think that the silica sand business is being overdone, as we have found most of our customers running slack for the last two years, with the exception of the last 60 days, which have been fairly busy."

The new plants that have been constructed during the past year and the prospects of further developments in 1929 mean that the many plants now operating will find their market much curtailed unless there is a decided rise in the consumption of glass sand and other silica products. At the present time it seems very unlikely that there will be any large growth in the demand for these products, and hence unlikely that the industry will thus find any relief from that source. A number of producers expressed themselves strongly on the subject of overproduction in the field, saying that unless something was done in a short time many of the plants that were not so well established would surely go under.

Mergers of Silica Sand Companies

Many of the producers said that consolidation in the industry was the big necessity in the silica sand field today. They pointed to the work done in the Ottawa, Ill., district where two such consolidations have been effected during the past year, as examples of how the trade should be getting together. In the Ottawa district there was much activity during the year, and on the whole, the plants fared better than in other sections of the country. Of particular significance was the merging of more than a dozen smaller companies of the district to form the new American Silica Corp., which was incorporated early in the year for half a million, and which has already issued $1,250,000 in bonds. This new grouping brings together many of the little companies producing crude silica into an operating unit which will be able to compete successfully with the large companies of this district. It will do much to cut down overhead and wasteful overproduction in the district and should serve as an example to the numerous plants in other locations. The other merger in the Ottawa district was accomplished when the Ottawa Silica Sand Co. purchased the entire holdings of the United States Silica Co., thus bringing together two of the largest producers in the district. The purchase brought the new plant of the U. S. company, which was only completed in 1927, under the control of the Ottawa company.

Although a number of producers were in favor of consolidations, it seemed that they were not all of the same mind when discussing some form of a national association. However, the response on this was far more gratifying than a year ago when everyone seemed opposed to any form of an association, as this year a number of producers stated definitely that they could see the advantage of an association and were strongly for one. The phases of work suggested by the producers that could be accomplished by such an association included stabilizing prices, securing protection from foreign imports, and standardization of meshes, quality, color, etc. One letter suggested that if a meeting of producers could be arranged by a "neutral" agency, such as the trade papers, so that the operators of the various plants could come together, get acquainted, and have a general discussion of the benefits of an association, then much might be accomplished toward forming a permanent association.

Imports of Silica

Imports of foreign silica sand products did not seem to trouble producers to any great extent during 1928. Producers spoke of it as being somewhat harmful to their market, but stated that home competition hit them much harder. If the Belgian sand is sustained on the duty list it should not be a great factor in the future. Plate glass imported into the United States in 1927 was valued at $2,689,017, while for the first ten months of 1928 it was $2,067,297, indicating that the year's imports will be practically the same as in 1927. Window glass imports, however, showed a sharp reduction from $1,359,349 in 1927, to only $622,406 in the first ten months of 1928.

New Plants of the Year

A number of new plants have been placed in operation in widely separated parts of the country during the past year. The Cape Silica Sand Co. of Cape Girardeau, Mo., completed its $75,000 plant in the spring and began turning out about 120 tons daily This is only the first unit of a plant which will eventually have three or possibly four units. On the west coast the opening of the plant of the Crystal Silica Sand Co., at Oceanside, Calif., near Los Angeles, is of the most importance. This is said to be the largest silica sand plant in western United States, putting out about 350 tons daily. The plant is laid out to make the utmost possible use of gravity for conveying, and also is operated throughout by remote control. It began operation in August.

One other new development of the year seems to be of particular interest. This is incorporation of the White Rock Silica Sand Co. of Browntown, Wis., to work new deposits of silica at that location, thus opening up an entirely new field. The company completed a new plant during the year which is reported to have a capacity of 300 to 400 tons daily of graded and washed sand.

Notes on the Industry in General

In the East, the Pennsylvania Glass Sand Corp. increased its capitalization for the purpose of acquiring other properties. It is unquestionably one of the biggest factors in that territory through this control.

The Standard Silica Co. of Chicago, operating a plant in the Ottawa district, completed a new grinding plant with a capacity of 50 tons of silica flour daily. This gives this company a complete line of silica from crude sand to silica flour.

The Missouri Silica Mining and Manufacturing Co., St. Louis, installed a complete sand

dryer, and finished other additions and improvements to its plant. The Silica Products Co., Guion, Ark., installed a new boiler plant and special grading machinery.

A new development in the Ottawa district was the incorporation of the Ottawa Sands, Inc., a new company building a plant just west of Ottawa. The crude sand producing equipment is to be completed first, and will be followed by the construction of a new washing plant.

Technical Developments

No particularly new developments in the silica sand industry are noted during 1928. In the east, operators are satisfied with the use of the chaser mills and screw washers, finding them the most economical and best for production so that generally the changes have been in other equipment. However, one manufacturer states htat increased size in washers is becoming common, and that where formerly 20-in. and 22-in. washers were ordered, now the producers are installing 30-in. ones. Similarly, larger crushing units are becoming popular.

Another development is the tendency toward elimination of hand labor through the use of more up-to-date methods of handling drained sand, and the installation of steam or electric shovels in the quarries and pits.

Opinions of Producers

The operators who answered ROCK PRODUCTS questionnaires were quite outspoken for the most part, and some of their remarks so hit the point that it would be well to quote them. Limited space prohibits too much attention being given to these answers, but here is how some of the producers feel about the industry:

Effect of Importations

Has not affected us materially, but no doubt has cut the consumption of silica sand. —*Illinois.*

* * *

Detrimental.—*Ohio.*

* * *

Small effect on the Ottawa District.—*Illinois.*

* * *

We have felt no important effect other than usual lessened production of glass manufacturers, but no serious handicap.—*California.*

A National Association

Very much in favor of an association. Think others of same opinion, as they have so many problems to be worked out.—*Illinois.*

* * *

A national association would be of little benefit.—*Illinois.*

* * *

Yes, for the standardization of meshes, quality, color, and types best suited for each requirement.—*California.*

* * *

The time is not ripe; no interest is displayed by sand producers in association work.—*Ohio.*

Are Producers Affected by Freight Rates?

Not seriously.—*Ohio.*

* * *

Classifications in some districts need to be revised.—*Illinois.*

What the Industry Needs

Death of a few purchasing agents.—*Illinois.*

* * *

The greatest need is to get a better price on silica.—*Missouri.*

* * *

Standardization.—*California.*

* * *

To get the industry in strong hands through consolidation as has been done in the Ottawa District. In this way the big over-production could be controlled.—*Ohio.*

* * *

Fair and stable prices which this industry has not had for several years.—*Illinois.*

* * *

Consolidation, to guarantee to producers a reasonable profit on their operation.—*Ohio.*

Program of the National Sand and Gravel Association

FOLLOWING is the program of the thirteenth annual convention of the National Sand and Gravel Association, January 9-10-11, 1929, Hollenden hotel, Cleveland, Ohio:

WEDNESDAY, JANUARY 9—10:30 A. M.

Morning Session

9:00 Registration.
Registration desk located on mezzanine floor. Present your railway certificates.
10:30 President's Opening Address.
10:45 Address of Welcome—B. F. Hopkins, City Manager of Cleveland.
11:15 "Know Your Association"—Dr. Hugh P. Baker, Manager, Trade Association Department, United States Chamber of Commerce.
12:00 Luncheon of Producers' and Manufacturers' Division.
Open Forum on Operating Problems in the Sand and Gravel Industry. J. L. Shiely, Chairman.

Afternoon Session

2:30 Opening of Machinery Exhibit by the Manufacturers' Division. H. M. Davison, Chairman.
2:45 Executive Meeting of the Board of Directors.
The Board will:
1. Outline plans for association activities during the ensuing year.
2. Prepare a budget of expenditures.
3. Nominate candidates for offices of President, Vice-President, Secretary-Treasurer and three Directors-at-Large.
4. Select from their own number four members of Executive Committee for the year 1929.
5. Consider a revised basis for assessment of dues.

THURSDAY, JANUARY 10—10:30 A. M.

Morning Session

10:30 Report of Officers.
President, R. C. Fletcher.
Secretary-Treasurer, Earl Zimmerman.
Executive Secretary, V. P. Ahearn.
Director, Engineering and Research Division, Stanton Walker.
11:15 "The Use of Gravel as Railroad Ballast"—J. A. Heaman, Chief Engineer, Grand Trunk Railway, Detroit, Mich.
12:00 Adjournment.
12:30 Meeting of Members of Committee on Standard Specifications. Meeting to be held during luncheon in Suite 100.

Afternoon Session

2:30 "Two Course Concrete Pavements"—Major Theron M. Ripley, Chief Engineer, Greater Motorways System, Erie County, New York.
3:00 "Manufacture, Delivery and Sale of Ready-Mixed Concrete"—Norman Beggs, Portland Cement Association.
Discussion of Mr. Beggs' paper by the following:
A. W. Dann, Keystone Sand and Supply Co., Pittsburgh, Penn.
John Price, Stewart Sand Co., Kansas City, Mo.
Alexander Foster, Jr., Charles Warner Co., Philadelphia, Penn.
Stephen Stepanian, The Arrow Sand and Gravel Co., Columbus, Ohio.
R. M. Quigley, Fort Worth Sand and Gravel Co., Fort Worth, Texas.
A. A. Levison, Blaw-Knox Co., Pittsburgh, Penn.
J. E. Burke, Ready-Mixed Concrete Co., Pittsburgh, Penn.
6:30 Banquet and Entertainment.

FRIDAY, JANUARY 11—10:30 A. M.

Morning Session

10:30 Report of Committee on Expense involved in Cleaning and Repairing Railroad Cars by Sand and Gravel Industry. J. C. Buckbee, Chairman.
10:45 Report of Committee on Marine Compensation Insurance. J. L. Richmond, Chairman.
11:00 "Transportation in Its Relation to Business"—H. G. Taylor, Manager, Public Relations Sections, American Railway Association.
11:30 "Benefits of Safety Campaigns in the Mineral Industries"—W. W. Adams, United States Bureau of Mines, Washington, D. C.

Afternoon Session

2:30 Report of Committee on Standard Specifications. Stephen Stepanian, Chairman.
2:45 Report of Committee on Standard Depreciation Scale. George A. Rogers, Chairman.
3:00 Report of the Board of Directors.
4:00 Adjournment.

SPECIAL ENTERTAINMENT ARRANGED FOR THE LADIES OF THE SAND AND GRAVEL CONVENTION.

WEDNESDAY, JANUARY 9

Wednesday Morning

Arrival at the Hollenden Hotel and Reception by Mrs. Hader Johnson, Official Hostess.

Wednesday Afternoon

At 2 o'clock a tea in Suite 100 of the Hollenden Hotel.

THURSDAY, JANUARY 10

Thursday Morning

At 9 o'clock the ladies will be taken for a trip through the Federal Reserve Bank of Cleveland. This will be very instructive and intensely interesting. From there they will go to the Observatory Tower in the Union Terminal Building, where a magnificent view of Cleveland is afforded.

Thursday Afternoon

At 12 o'clock noon, luncheon will be served for the ladies at the Cleveland Art Museum. This will be followed by an inspection of the rare paintings and art objects in the museum, after which a sight-seeing trip has been arranged through some of the parks and boulevards of Cleveland, including a stop at the Shakespearean Garden. The party will return to the hotel by 4:30.

Thursday Evening

At 7 o'clock the annual banquet will be held at the Hollenden Hotel. There will be dining and entertainment, after which an orchestra will furnish music for dancing.

FRIDAY, JANUARY 11

Friday Morning

Promptly at 9 o'clock the ladies will be taken on a personally conducted shopping tour through two of the leading department stores of Cleveland. From there they will go to the Bell Telephone Co. of Cleveland and will be given an intimate view of one of the largest automatic telephone systems in the world.

Friday Afternoon

The ladies will be guests of the Association at Keith's Palace Theater, referred to as the most beautiful theater in America. At the conclusion of the performance the ladies will be taken for a tour back stage where the intricacies of the theater will be shown to them.

Friday Evening

This is the closing day of the convention. Many visitors will be leaving for home. Others will remain over, and those who do will find many excellent shows in Cleveland. Full information in this regard may be obtained at the registration desk.

Investigations at Bureau of Standards Dealing with Cement, Lime Gypsum and Stone*

FOLLOWING a custom of several years' standing, we include in our annual review of the rock products industry a summary of the work done and under way by the United States Bureau of Standards:

Investigation of the Physical Properties of Cast Stone

A total of 44 samples of cast stone made by 21 manufacturers scattered throughout the United States have been collected in the study of the properties of this material which is being made as a basis for the preparation of a federal specification.

Following is the procedure of testing:

(1) Six 2x2-in. cylinders and three 1x1x8-in. prisms are cut from the specimen.

(2) These are dried at 110 deg. C. to a constant weight, which usually requires 48 hours.

(3) Modulus of rupture measurements are made on the prisms, using a 6-in. span.

(4) Three of the broken halves of the prisms are weighed, totally immersed in water, and the rate of absorption determined over a period of 48 hours. The specimens are then boiled five hours and, assuming that the pores of the specimen are filled with water, the porosity is determined.

(5) Compressive strength is determined on three 2x2-in. cylinders.

(6) The remaining three 2x2-in. cylinders are subjected to alternate cycles of freezing and thawing in water at 21 deg. C., the specimens being immersed for 48 hours previous to the first freezing. The specimens are kept immersed in ¼ in. of water at the beginning of each freezing cycle.

Stress-strain readings have been made on a number of 2x2x4-in. prisms, where the material in the sample was sufficient to obtain the extra specimens.

The range of the values obtained so far are as follows:

	Maximum	Minimum
Compressive strength, lb./sq. in., of 2x2-in. cylinders	10,300	2,370
Modulus of rupture, 1x1-in. bar on 6-in. span	1,575	375
Absorption, 48 hr. in water at 21 deg. C., by weight, per cent	10.8	3.3
Absorption, same as above, followed by 5-hr. boiling, per cent	14.6	7.3
Porosity—		
Per cent by volume	33.8	16.0
Secant modulus of elasticity at 50% compressive load, lb./sq. in.	3,300,000	1,400,000
Cycles of freezing and thawing to cause failure	380	62

*Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

A group of over 500 test cylinders of concrete containing large sized crushed stone as the large aggregate and screenings from crushing the stone as the fine aggregate, representative of the material used in the Santeetlah Dam, S. C., were tested for compression at the approximate age of three months. The cylinders varied from 2 to 36 in. in diameter and the height was equal to twice the diameter. The largest size aggregate present in the 36-in. cylinders varied from ⅜ in. to 10 in. As the cylinder diameter was decreased the largest size aggregate present was reduced.

Another group of cylinders, including specimens of every size, was made in the proportion of 1 part cement to 2.7 parts of aggregate, all aggregate having been smaller than the ⅜-in. sieve. In this group the 36-in. cylinders developed an average compressive strength of 2550, the 12-, 18- and 24-in. specimens approximately 3000, the 6- and 8-in. specimens 4100, and the 2- and 3-in. specimens approximately 5100 lb. per sq. in.

In the other groups of cylinders, the 36-in. cylinders contained aggregate of maximum size varying from 2½ to 10 in., proportions being approximately 1:3:3, 1:3:4, and 1:3:4.6. Before filling the 8-in. molds, all aggregate above 2½ in. was removed from the concrete, for the 6-in. molds all above 1½ in., and for the 2- and 3-in. molds all above ⅜ in. The strength of the 36-in. diameter cylinders varied from 1500 to 3100 lb. per sq. in., compared with the minimum and maximum average strength of 2260 and 4400 for the 8-in. and 3130 and 4700 for the 6-in. cylinders. There was a general tendency for the smaller specimens to give higher strengths.

Strength of Large Concrete Cylinders

Stress-strain readings were taken on the 18- and 36-in. diameter cylinders, readings being taken without stopping the application of load. The readings were continued until maximum load was reached. The ultimate strains varied from 0.0015 to 0.0032 in. per inch, and the initial modulus of elasticity varied from 2,200,000 to 3,600,000 lb. per sq. in. In all cases the average modulus for the 36-in. cylinders was higher than for the 18-in. cylinders.

A small amount of data of interest was obtained on the rate of deformation of cylinders during test. The rate of deformation of the cylinders tested is very slow at first, gradually increasing in value, becoming practically constant and remaining so throughout the greater part of the test. With an idle head speed of 0.055 in. per minutes the head speed was slowed down to 0.04 in. per minute during tests of 6-in. cylinders capped on both ends with plaster of paris, the deformation of the specimen being about 0.0037 in. per foot per minute. When cylinders with ground ends without caps were tested the head speed was slowed down still further, to approximately 0.02 in. per minute, and the rate of deformation of the specimen was about 0.007 in. per foot per minute.

Durability of Concrete Aggregates

The durability of concrete aggregates when subjected to weathering is an important question confronting the users of concrete, the disintegration of rock being geologically attributed in large part to alternate cycles of freezing and thawing. The freezing and thawing of test specimens to determine their resistance to this process is a procedure of such length that accelerated tests are desirable, three such tests having been proposed, the sodium sulphate, the sodium chloride, and the boiling and drying cycle. Thirty-six varieties of the most common representative coarse aggregates throughout the United States have been collected, these including three granites, four trap rocks, four sandstones, seven limestones, six slags and twelve gravels, the latter containing limestone, sandstone, granite, quartz, glacial gravel, and slaty schist.

The aggregate before testing was all screened to pass a 1-in. mesh and to be retained on a ¼-in. mesh, and the grading of the samples was determined both before and after the durability tests. The aggregates were analyzed to determine the stratification, texture, and mineral content, and the apparent specific gravity, porosity, and cold water absorption were also determined. Samples weighing 40 lb. were each subjected to the sodium sulphate, sodium chloride, boiling and drying, and freezing and thawing tests for 150 cycles.

After this treatment all samples were again sieved on a ¼-in. mesh screen to eliminate all of the smaller disintegrated particles and the aggregate made up into a 1:2½:3½ concrete and formed into 6-in. cubes. These cubes were placed in damp storage for three months and tested. All specimens have been made up, but the compression tests are not completed.

Of the types of aggregate used in this test the limestones apparently show the greatest disintegration. The gravels are composed of such a variety of stone that disintegrated particles are found in most of them, but with few exceptions by far the greater number of pieces are sound. Granite and slags have not been affected, and only occasional pieces of trap rock have shown signs of breaking up under these tests. From the results there

does not appear to be a very definite relation between the various tests, the sodium sulphate and boiling tests, however, apparently being the most severe.

The Workability of Concrete

The study of the methods for measuring the workability of concrete was pursued during the year and the results presented before the American Concrete Institute. As an introductory investigation the velocity of a small ball pulled through a cement paste gave interesting results. The apparatus, however, could not be applied to measure the workability of concrete.

The flow table was used with slab top and with a concave conical top, ½-in., ⅛-in. and $\frac{1}{16}$-in. drops being used in each of a series of measurements. A study was made of the distribution of the coarse aggregate after flow, the mass of the concrete being separated by a circular cutter into two equal parts.

A flexible metal cylinder filled with concrete was impacted 30 times by a drop of $\frac{1}{16}$ in. on the flow table. The cylinder was then laterally squeezed by applying load at a constant rate. The workability was measured by the load required to produce a certain deformation.

The last apparatus used was a modification of the penetration rod, the first modification being the substitution of a falling weight for the weight of the rod, this weight falling a constant distance at each blow. The number of blows required to produce an 11-in. penetration was the inverse measure of the workability. The apparatus was further modified by the addition of two more rods. This latter apparatus is apparently the most sensitive, but it is not believed that it gives all the information needed to indicate true workability.

A Study of the Reaction of Water on the Calcium Aluminates

In this study the four calcium aluminates ($CaO \cdot Al_2O_3$, $3CaO \cdot 5Al_2O_3$, $5CaO \cdot 3Al_2O_3$, $3CaO \cdot Al_2O_3$) have been made and the mechanism of their reaction with water has been studied. Tricalcium aluminate, possibly the only aluminate present in portland cement of normal composition and normal properties, reacts so rapidly with water that the changes in composition of resulting solutions could not be followed. The monocalcium aluminate and the 3:5 calcium aluminate occur in cements characterized by a high alumina content.

These two aluminates together with the 5:3 calcium aluminate and high alumina cements react with water to form metastable and supersaturated monocalcium aluminate solutions in the early periods. The metastable solutions decompose as the reaction proceeds with the precipitation of varying amounts of hydrated alumina and crystalline hydrated tricalcium aluminate with attendant increases in both the pH and molecular ratio, CaO/Al_2O_3, in the resultant solutions. If the metastable solutions are filtered from the reaction mixtures, they also decompose with the precipitation of the above phases. The resultant solutions, which are in equilibrium with these two phases, apparently attain the same composition as those left in contact with the calcium aluminates or high alumina cement for long periods.

A study of the subsequent changes in the aluminate solutions attended by increasing concentration of calcium hydroxide, a product of the hydrolysis of the calcium silicates, shows that the alumina is almost completely precipitated from solution at a pH of 12.0 or above. A hydrated tetracalcium aluminate appears to be precipitated at this pH value.

Calculations based upon electrometric measurements and chemical analyses indicate that the alumina in the aluminate solutions is in combination with lime as the calcium salt of monobasic aluminic acid.

Tricalcium silicate and *beta* dicalcium silicate appear to hydrolyze less in an aluminate solution than in water.

An electrometric titration study of aluminum chloride and calcium hydroxide was also carried out. The conditions under which the aluminum precipitates as the hydroxide and as the calcium chlor-aluminate were studied. The formation of calcium chlor-aluminates from the reaction of calcium chloride with aluminate solutions was also studied.

The optical properties of the various hydration products were obtained. A paper presenting the data, a discussion of these and the conclusions drawn, is now in the hands of the public printer.

Constitution of Portland Cement

In co-operation with the Portland Cement Association, researches which may be divided into three main classes have been under way. They are:

1. Studies on the constitution of portland cement.

2. Studies of the reaction of setting and hardening and the behavior of cement in use.

3. The influence of each component on the temperature required to burn the cement and on the cementing value of the product.

Seven investigations in this program have been completed and reported during this period. These are listed below.

The investigations on the constitution of portland cement during this period have been concerned primarily with systems in which ferric oxide and magnesia are components. These studies have shown the existence of two new compounds. These have the formulae $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$ and $4CaO \cdot 2MgO \cdot Al_2O_3 \cdot Fe_2O_3$. These compounds form a complete series of solid solutions with each other. The Fe_2O_3 in portland cement is probably combined either as $4CaO \cdot 2MgO \cdot Al_2O_3 \cdot Fe_2O_3$ or its solid solution with $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$. The other studies on magnesia show that any MgO in excess of that required to combine with the Fe_2O_3 as $4CaO \cdot 2MgO \cdot Al_2O_3 \cdot Fe_2O_3$ possibly remains as uncombined MgO in the cement.

In a research reported last year, the behavior of the cement compounds in an excess of water was studied. That work has been extended this year to the behavior of those compounds in concentration of water similar to those used in concrete practice. The materials are made into paste with water and sealed in glass vials. At regular intervals the vials are broken away from the specimens and these tested for compressive strength and water of hydration. Microscopic and x-ray examinations of the specimens are made to determine the nature of the end-products of these reactions. So far $Ca(OH)_2$ and hydrated $3CaO \cdot Al_2O_3$ are the only crystalline products which have been identified.

In another investigation the pure compounds, laboratory cements, and commercial cements are made into mortar specimens and these immersed in solutions of salts. The salts used are those found in sea and alkali waters. The specimens are examined at regular intervals for corrosion and for compressive strengths. These investigations are not completed, and no correlation of results can be made at this time.

Systematic studies are being carried on to determine the effect of each component upon the temperatures required to produce cement and upon the cementing properties of the product. The components of the mixtures are caused to vary by replacing a part of one by another or by direct addition of one to a given mixture of other components. Starting with a base mixture of CaO, Al_2O_3, and SiO_2, it has been found that replacing a part of the CaO by MgO or a part of the Al_2O_3 by Fe_2O_3 or both generally decreases the temperatures required to burn the mixtures to complete combination. In general the replacement of Al_2O_3 by Fe_2O_3 increases the strength of the cement; whereas, the replacement of CaO by MgO usually causes a slight decrease in the strengths of the cements. The addition of MgO to the mixture usually affects the strengths very little.

All of the studies on portland cement require the use of such tools as the petrographic microscope and x-ray equipment. The x-ray diffraction patterns and optical properties of many of the compounds encountered in these studies have been determined and published.

PUBLICATIONS—

Paper No. 12, "Further Studies on Portland Cement Compounds by the X-ray Diffraction Method," by W. C. Hansen; *Journal of the American Ceramic Society*, **11**, 68 (1928).

Paper No. 13, "Studies on the System Calcium Oxide-Alumina-Ferric Oxide," by W. C. Hansen, L. T. Brownmiller and R. H. Bogue; *Journal of the American Chemical Society*, **50**, 396 (1928).

Paper No. 14, "Equilibrium Studies on Alumina and Ferric Oxide and Combinations of These with Magnesia and Calcium Oxide," by W. C. Hansen and L. T. Brownmiller; *American Journal of Science*, **15**, 225 (1928).

Paper No. 15, "A New Registering Photodensitometer," by E. A. Harrington: *Jour-*

nal of the Optical Society of America, **16,** 211 (1928).

Paper No. 16, "A Precision Method for Measuring Temperatures of Refractive Index Liquids on a Crystal Refractometer and on a Microscope Slide," by F. W. Ashton and W. C. Taylor; *American Mineral,* **13,** No. 8, 411 (1928).

Paper No. 17, "A Digest of the Literature on the Nature of the Setting and Hardening Processes of Portland Cement," by R. H. Bogue; *Rock Products* (1928) (Serial form).

Paper No. 18, "Phase Equilibria in the System $2CaO \cdot SiO_2$-MgO-$5CaO \cdot 3Al_2O_3$," by W. C. Hansen; *Journal of American Chemical Society,* **50,** 2155 (1928).

Expansion and Contraction of Portland Cement Mortars

This investigation was instigated to ascertain the cause of crazing in mortars and stuccos and if possible to find a method or means of prevention.

Three sands screened between the 4- and 8-mesh, the 8- and 30-mesh, and the 30- and 100-mesh were used. These were mixed in varying proportions to obtain 10 graded sands of different surface areas. The mixes made of these 10 graded sands were in the proportions of one part of portland cement to three parts of sand. Each mix was applied upon three different bases, namely: an absorptive base, made of concrete, a non-absorptive rigid base of glass, and a non-absorptive, elastic base of rubber sheeting stretched over a glass plate.

These showed very little crazing as long as they were stored in the laboratory, but after a few months exposure on the roof crazing developed on a number of the slabs. After a year and a half on the roof, nearly all of the slabs with the glass and rubber bases crazed, while the slabs on the concrete bases show crazing in only a comparatively few cases.

This seemed to show that controlled conditions of temperature and humidity were necessary, at least during the early hardening period of the mortar, to indicate which of the stuccos are distinctly better than others under the most severe conditions, such as high temperature and low humidity and under the most favorable conditions such as low temperatures and high humidity. Slabs 24 in. by 24 in. by 1 in. of 1:3 mortar were made on concrete bases in a constant temperature and humidity box. Half of the base of these slabs was wetted when the mortar was put on, and when the mortar had begun to harden, half was troweled smooth. This made four sections to each slab, namely, a dry base untroweled section, a wet base untroweled section, a dry base troweled section, and a wet base troweled section.

Duplicate slabs were made of each mix and one was stored in the laboratory, while the other was placed on the roof to weather. These mixes were made under the following controlled conditions of temperature and humidity:

1. 100 deg. F. and 40% to 50% humidity
2. 100 deg. F. and 75% to 90% humidity
3. 85 deg. F. and 40% to 50% humidity
4. 85 deg. F. and 75% to 90% humidity
5. 70 deg. F. and 20% to 30% humidity
6. 70 deg. F. and 40% to 50% humidity
7. 70 deg. F. and 80% to 90% humidity

Inspections of the slabs on the roof and in the laboratory are carried out at regular intervals, but as yet no definite conclusions can be drawn.

PUBLICATIONS—

"Notes on the Progress of Some Studies of the Crazing of Portland Cement Mortars," by P. H. Bates and C. H. Jumper; *Proceedings of the American Concrete Institute,* Vol. XXIV, pages 179-189 (1928).

Workability of Cements

The efforts to devise methods suitable for studying the differences in workability of cements included four types of apparatus for comparing the neat cement pastes: (1) the capillary tube; (2) the ball plasticimeter; (3) the extrusion cylinder; (4) a modified MacMichael viscosimeter. A dozen portland cements, each made at a different mill, have been studied. With each apparatus interesting data were secured.

The application of the MacMichael viscosimeter was extended to mortars. The scope of this instrument was limited as to size of aggregate and stiffness of mix, but the results emphasized the necessity of comparing the workability of a number of cements under the same conditions of mix in which they are to be used in practice. The results obtained with this viscosimeter were found sufficiently interesting to warrant the construction of a larger machine, of somewhat similar type, but capable of covering a wider range of mixes.

The study of the workability of concretes was continued, with modifications of the penetration apparatus and the deformable cylinder used in earlier work.

PUBLICATIONS—

"Cement as a Factor in the Workability of Concrete," by P. H. Bates and J. R. Dwyer; *Proceedings of the American Concrete Institute,* Vol. XXIV, pp. 43-55 (1928).

"A Study of Some Methods of Measuring Workability of Concrete," by George A. Smith and George Conahey; *Proceedings of the American Concrete Institute,* Vol. XXIV, pp. 24-42 (1928).

Branch Laboratories and the Inspection of Portland Cement

The Bureau maintains three branch laboratories. The Northampton, Penn., laboratory is devoted exclusively to the inspection and testing of portland cement and being advantageously located in the Lehigh Valley cement producing district supervises the major portion of the government purchases of tested cement in the East. The San Francisco laboratory tests cement and miscellaneous materials purchased on the West Coast. The Denver laboratory tests concreting materials mainly in connection with reclamation projects, and tests cement in the territory west of the Mississippi not covered by the San Francisco laboratory. Some 1,343,000 bbl. of cement were sampled and tested during the fiscal year 1927 (July 1, 1927, to June 30, 1928).

Heat of Reaction of Portland Cement and Water

A study of the heat of reaction of portland cement and water is in progress.

The cement is mixed with a definite proportion of water in a small can, a thermocouple placed in the cement mixture, and the can fitted into a thermos bottle. The latter is then placed in an insulated cabinet maintained at 21 deg. C.

The temperature changes taking place during the first 24 hours are recorded on a potentiometer. Relative values were obtained on a large number of commercial portland cements, special early strength cements, including high alumina cements, and also on some of the pure compounds of cement.

An endeavor was made to correlate this heat of reaction of cement with the strength, fineness, time of set, the ratio of SiO_2 to Al_2O_3, the ratio of CaO to $SiO_2+R_2O_3$, CaO, and volume changes. There does not seem to be any very definite relation, however, between these several properties of the cements and the heat of reaction, with the possible exception of the time of set.

PUBLICATIONS—

Report of Tests on Stevenson Creek Dam, by W. A. Slater, *Proceedings of the American Society Civil Engineers,* May, 1928.

Some Features of the Testing of Stevenson Creek Arch Dam, by W. A. Slater, *Proceedings of the American Concrete Institute,* Vol. XXIV, p. 273 (1928).

Aggregates for Concrete

For economical concrete construction, it is usually necessary to use the sands and coarse aggregates in the sizes and gradings as found or produced, the cost of extensive screening operations to regrade the aggregates being too great to warrant the use of that method of forming the desired gradation for a particular use. It is known in a general way, that workable concrete mixtures can be made with aggregates of widely different types and gradings. It is possible also to proportion the ingredients so that a concrete of satisfactory strength may be obtained. No rules have been devised, however, for proportioning the ingredients to secure workable mixtures and, at the same time, concretes of the desired strength at the least cost.

An investigation has been made to determine the effects of the sizes, gradations and proportions of gravel, crushed stone and slag aggregates on the strength and economy of concretes. Although the investigation included tests with 232 different combinations of cements and aggregates, this is only a small proportion of the possible combinations and it will be necessary to make further studies before many of the questions involved can be satisfactorily answered.

The results indicate, in general, that many commercial concrete mixtures would be more workable and at the same time would give equal strengths at a lesser cost, if larger proportions of sand to coarse aggregate were used. Taking the strength per quantity of

cement per cubic yard of concrete as a measure of the economy of a mixture, it was found that the most economical mixtures contained from one-half to one volume of sand per volume of coarse aggregate. The minimum strengths of the concretes, which were not deficient in sand, were closely related to the water-cement ratio, the minimum proportion of sand in each case being the same as that required to produce a satisfactorily workable mix and to give the maximum economy of cement. A complete report on the investigation is being prepared for publication in the Bureau of Standards *Journal of Research.*

Improvement of Hydrated Lime

Producers of hydrated lime from quicklime have found occasionally that an undue amount of residue is obtained in the hydration process. This residue represents considerable loss as it has no commercial use and must be rejected. In an attempt to determine the cause of this residue, samples of quicklime have been obtained, from producers who have unusually large amounts of unslakable residue. Analyses of the stone, quicklime, and residue have been made. A high calcium quicklime producing about 5 per cent residue was examined. It was found that practically all the magnesia had concentrated in the residue. Some concentration of silica also occurred. With a magnesium lime, the concentration of silica in the residue was more noticeable while little concentration of magnesia was evident.

Properties of Chemical Limes

The preparation of specifications for lime for chemical uses requires a thorough knowledge of the properties of the various limes available for such purposes. An investigation of the properties of commercial chemical quicklimes has therefore been undertaken to develop data which may be used in the preparation of specifications. Thirty-five samples of chemical limes, including both quicklimes and hydrates, were obtained for use in this investigation. The chemical analyses of these limes, including the determination of the less common constituents, such as phosphorous, manganese, arsenic, etc., were made.

As the amounts of coarse residue obtained on slaking a quicklime is important in considering the nature and design of processing apparatus, a sieve analysis of each putty obtained on slaking seventeen of the above mentioned quicklimes was made. The residues on a No. 30 sieve varied from 0.7 to 50.1%, and the amount passing a No. 200 sieve varied from 46.0 to 96.1%. The available lime content of these quicklimes was determined by the modified Scaife method. It was found to vary from 37.9 to 97.1%. No relation could be found between the available lime content and either the fineness or the chemical composition of the lime. The results indicated the desirability of considering all three factors in evaluating a lime for chemical purposes.

PUBLICATIONS—

Composition of Commercial Chemical Limes, J. S. Rogers, *Industrial and Engineering Chemistry,* Vol. 19, No. 10, Oct., 1927, p. 1157.

Fineness and Available Lime Content of Chemical Quicklimes, J. S. Rogers, *Industrial and Engineering Chemistry,* 1928.

Adhesion of Plaster to Hollow Clay Tile

The adhesion of three kinds of plaster, gypsum, cement and cement-lime, to three different grades of hollow clay tile, namely, hard, medium and soft, was determined. Five different types of tile surface were available, combed, grooved, wire cut, smooth and glazed. The results varied from 5.4 lb. per sq. in. with a gypsum plaster on a soft grooved tile to 22.4 lb. per sq. in., with a cement-lime plaster on a soft combed tile. In all cases the plaster separated from the glazed tile under a force slightly greater than its own weight. The tile indicated that the adhesion is sufficiently great for safety with all types of plaster or tile tested, except in the case of glazed tile. Plaster should not be applied directly to the surface of glazed tile.

PUBLICATIONS—

"Adhesion of Plaster and Stucco to Hollow Clay Building Tile," by J. A. Murray and H. D. Foster.

American Architect, December 20, 1927, p. 839.

Contract Record, Vol. 42, No. 4, p. 80.

Brick and Clay Record, Vol. 72, No. 1, p. 34.

Development of a Sound-Absorbing Plaster

A sound-absorbing plaster, designed to remedy the acoustical defects of auditoriums, theaters, etc., has been developed. Briefly, it consists of a graded porous aggregate, held together with a binder of gypsum. A means of generating gas bubbles in the plaster before application to the wall consists of adding small amounts of ground limestone and potassium alum in equimolecular proportions. These gas bubbles further increase the porosity of the plaster and aid in the absorption of sound. Additions of sand to the mix may be used to decrease the absorption. The porous aggregates which have been found to be satisfactory are pumice, calcined diatomaceous earth, granulated tufa, and coral rock.

PUBLICATION—

"Development of an Acoustical Plaster," by M. C. Dailey. Distributed privately to members of the Gypsum Industries (sponsors of the investigation).

Tests of Sand-Lime Brick

An investigation of the strength of sand-lime brick has been made. Brick were obtained from six different plants and transverse, compressive, tensile and shear strengths were determined. The average values for these measurements are as follows:

Brick	A	B	C	D	E	F
Modulus of rupture, lb./sq. in.	580	580	600	620	780	660
Compressive on edge, lb./sq. in.	2360	2600	2600	2900	3500	3400
Shear, lb./sq. in.	1100	1400	1200	1000	1600	1600
Tensile, lb./sq. in.	190	180	175	200	220	200
Absorption, lb./sq. in.	13.3	15.6	20.0	17.3	20.7	25.2
Compressive flat, lb./sq. in.	3140	.....	.....	.....	.....	.....

A comparison of the individual values of compressive strength with the modulus of rupture of the same brick from plant *A* shows that a very good relation exists, and it is possible to predict fairly accurately the compressive strength from the modulus of rupture. A similar condition holds for bricks from plants *B* and *D*. On the other hand, very little relation between the two values on the other three makes of brick can be found. Consequently it cannot be accepted as a general rule that the compressive strength of sand-lime brick is proportional to the transverse strength or modulus of rupture. Similar conditions hold for the other strength tests.

A number of bricks from plant *A* were tested transversely, and then one-half of each brick was tested in compression flatwise and the other half in compression endwise. A study of the results obtained show that absolutely no relation existed between compression flat and compression on edge.

Adhesion of Mortar to Sand-Lime Brick

The strength of the mortar joint between brick may have an appreciable effect on the endurance of a masonry structure, particularly when subjected to unusual stresses, such as are caused by severe windstorms. An investigation of the adhesion of mortar is an important factor, for with a weak mortar, failure may occur in the mortar itself, rather than between the mortar and brick. A wet brick in general adheres more strongly to a given mortar than a dry brick, and with bricks of the same degree of moisture content, a wet mortar gives better results than a dry mortar. A brick with a high rate of absorption adheres more strongly than one with a low rate. The strength of the bond decreases with increased thickness of joint. Aging conditions affect the strength, probably due to changes in the strength of the mortar. For example, bricks mortared together with a cement mortar showed an adhesion of 27 lb. per sq. in. after aging 28 days in the air of the laboratory, while similar bricks aged 28 days on the roof, exposed to the weather, showed an adhesion of 95 lb. per sq. in.

Rate of Drying of Wall Plaster

An investigation of the time required to dry wall plaster under various conditions of temperature and humidity has been undertaken. Panels of gypsum, lime and cement plasters, both 2 and 3 coat, of thickness ½-in. and ⅞-in. have been dried in a constant temperature cabinet by circulation of air of constant humidity. Series of panels were dried at 15 deg., 22 deg., 30 deg., and 37 deg. C., using both dry air and air of about 70% humidity. At 30 deg., a two-coat, ½-in. panel of gypsum plaster required

140 hours to dry, using air 70% saturated, while a two coat, ⅞-in. back plastered lime panel required 376 hours under the same conditions. Other panels in the series required times intermediate between these limits. The results indicate that the time allowed for drying of plaster in ordinary construction work is insufficient. Finishing of plastered walls, either by painting or papering, should not be done before the plaster is thoroughly dried.

Properties of Gypsum Fiber Concrete

The use of gypsum fiber concrete for poured-in-place floor and roof construction has created a demand for knowledge of the properties of this material. In cooperation with the Gypsum Industries Association, the Bureau has been developing the data necessary for computing the allowable working stress on gypsum concrete. One series of tests was made using cylindrical 6-in. by 12-in. specimens. These were dried in the laboratory air for 28 days. The compressive strengths and elastic moduli of the specimens were then determined. A second series, similar to the first, was made, but the specimens were dried to constant weight in an oven at a temperature of 100 deg. F. The second series in general showed higher strengths than the first.

The determination of the modulus of elasticity of these poured specimens was subject to some uncertainty as the surface of the specimens was of different composition from the interior. Consequently a third series of tests was made, in an attempt to remedy this defect. Blocks of the gypsum fiber concrete, 20-in. by 40-in. by 7-in. were cast in a mold. After drying each of the blocks was cut into three specimens 4-in. by 4-in. by 36-in. The specimens were dried to constant weight at 100 deg. F. and the transverse strength and moduli of rupture determined. The moduli of rupture varied from 116 to 477 lb. per sq. in., depending on the composition of the concrete. After breaking transversely the specimens were cut into blocks 4-in. by 4-in. by 8-in. and compressive strengths of these blocks are to be determined and compared with that of 6-in. by 12-in. cylinders cast at the same time as the slabs.

Plastic Caulking and Pointing Materials for Masonry

The study of these materials during the past year has given considerable information in regard to their ability to maintain water-tight joints, staining properties and resistance to diurnal temperatures. Fifty-one trade materials are under test which are produced by twenty-seven different manufacturers. These are being studied in coping joints of limestone masonry and in various laboratory tests. The exposure tests indicate that 37% of the materials have failed and 20% are of doubtful value. Practically all cause stains on limestone masonry although most of the stains have disappeared within a year of weathering conditions.

Since these materials are usually required to possess sufficient plasticity and bonding properties to withstand structural movements, a test has been designed for determining these properties. This consists of a joint formed by three blocks of limestone and a means of moving one block to stress the pointing material an amount comparable to that occurring in masonry. Failure of the pointing material is indicated by leakage of water held in a recess behind the caulking.

Temperature Measurements in Limestone Masonry

This research is to determine the relation between outside air temperatures and that of various points in the masonry. This is of value in determining structural movements and the effect of temperature variations in the stone itself. Instruments have been installed at Portland, Me., Washington, D. C., and Jacksonville, Fla., which record the diurnal temperatures of the air and various points in the masonry of buildings. The highest surface temperature noted on the coping stone during the present summer was 120 deg. F. which was 23 deg. higher than that of the free air. At the same time the temperature 2 in. in the stone was 122 deg. and at a depth of 4 in. it was 113 deg. South wall temperatures at the same time were about 27 deg. lower than in the coping, while north wall measurements indicated temperatures 3 deg. to 5 deg. lower than in the south wall.

Structural Slate

In connection with the general investigation relating to the physical characteristics of slate 41 samples have been tested representing the products from Arkansas, Maryland, Virginia, Maine, New York and four producing districts in Pennsylvania. The results of the usual physical test are summarized as follows:

	Highest	Lowest	Average
Modulus of rupture (lb./sq. in.)	12,000	3,700	7,600
Modulus of elasticity (lb./sq. in.)	17,000,000	9,000,000	12,300,000
Per cent absorption by weight	1.41	0.06	0.34
Apparent sp. gr.	2.88	2.69	2.77

Weathering tests are in progress which consist of frost resistance and acid resistance determinations. The freezing tests to date indicate that slate is very resistant to frost action. The acid test which is intended to simulate the action of rain water has shown a rather pronounced surface action on some of the slates, producing blistering and discoloration. This effect appears to be confined mainly to a thin layer at the surface since the average reduction in strength of the slate is only about 7%.

Miscellaneous Research and Testing

During the year several minor investigations were undertaken when the desired information could not be obtained otherwise. Three of these related to the causes of discoloration or decay of marble under certain conditions. A study was made to determine the rate of solution of calcareous building stones where freely exposed to the elements. Another study was concerned with the contention that there is formed on stone a dense protecting film at the surface which lengthens the life of the material in masonry. A deposit of limestone in the south, having been developed and made available for extensive use in other parts of the country it was thought desirable to make a thorough study of its characteristics and past uses. A study of the elastic properties and Poisson's ratio of felsite was made at the instigation of the Reclamation Service.

Co-operating with other departments of the Federal Government, 13 samples of stone were tested for the U. S. Engineer Office in connection with the survey of the upper Tennessee River; 11 samples of the elastic pointing materials were tested for the Supervising Architect. Twenty-six miscellaneous samples of limestone, 11 samples of sandstone and 11 samples of marble were tested in connection with the general investigations of physical properties. Three samples of the base rock from the St. Francis Dam were studied to determine if unsatisfactory weathering resistance or lack of stability due to hydration effects had any relation to the dam failure.

Wear Measurements on Flooring Materials

An apparatus has been designed and constructed for determining the relative wearing qualities of various stone flooring materials. A series of tests has been made with this apparatus on thirty-three materials which were also submitted to wear under actual service conditions in the treads of steps. A comparison of the results indicate that the apparatus gives results which are comparable with the actual wear under foot traffic.

A paper describing the apparatus and results of tests on ninety materials was presented at the meeting of the American Society for Testing Materials in June, 1928 which will be published in the Proceedings of that Society for 1928. The same paper will also be published in an early issue of the journal *Through the Ages.*

Water Softening

SOFNOL, LTD., Westcombe Hill, Greenwich, S. E. 10, have published six pamphlets dealing with the various phases of water softening. The first of the series, a pamphlet, "The Chemistry of Water Softening," outlines the basic chemical reactions involved in the various processes in simple terms, and describes the properties of reliable water softening compounds. Separate booklets describe the use of calcium hydrate, calcium sodium hydrate (soda lime) and their special water softener compound, "Sofnolite," and discusses its advantages. Descriptive literature covering the apparatus used for water testing, a discussion of indicators, their use and limitations is also included in the series of publications.

Work of the American Society for Testing Materials on Rock Products, 1928

Committees on Cement, Lime, Gypsum and Aggregates

Committee C-1 on Cement

By F. H. Jackson, Secretary

THE MAJOR INTEREST of Committee C-1 on Cement during the past two years has been concerned with a very extensive study of the so-called fluid cement test first proposed by Professor Abrams, with a view to determining whether or not such a test could be substituted for the present briquette test on portland cement. A very extensive series of tests on 32 brands of portland cewent was undertaken with 52 laboratories co-operating. The results of this investigation were reported to the A. S. T. M. at the last annual meeting. These data fail to show that the fluid cement water was more satisfactory than the present test and it was consequently decided to investigate during the present year a plastic mortar cement test similar to the one suggested by the Lehigh Portland Cement Co. and described before the A. S. T. M. at its last meetng.

In the series of tests outlined for this year advantage will be taken of a number of facts which developed during the previous investigation, and it is hoped that more indicative results will be secured. The tests will be limited to eight brands of cement and the work will be done in eight testing laboratories. Preliminary tests will be run in all of the laboratories for the purpose of determining how closely they can check their results on identical materials.

Committee C-7 on Lime

By W. V. Brumbaugh, Secretary

COMMITTEE C-7 has held three meetings during the past year as follows: Marsh 21, 1928, Washington, D. C.; June 27, 1928, Atlantic City, N. J. (held in conjunction with annual meeting of the Society); November 20, 1928, Washington, D. C.

Ten new members have been elected to the committee during the year and two resignations have been received. The membership now stands at a total of 37, divided into three groups as follows: producers, 18; consumers, 8; and general interests, 11.

The officers of the committee, who were elected at the June meeting to serve during the next two years, are listed below: Chairman, H. C. Berry; vice-chairman, E. E. Eakins; vice-chairman, J. M. Porter; secretary, W. V. Brumbaugh.

Because of improvements which were developed in the method for determining the plasticity of hydrated limes, as described in C6-24, "Standard Specifications for Hydrated Lime for Structural Purposes," subcommittee V recommended that certain revisions be adopted. The changes were considered necessary to reduce errors in plasticity measurement caused by relatively slight differences in the method of preparing the putty; by differences in the absorption of different lots of base plates; by different methods of cleaning and care of base plates; and to provide a standard method for measuring the absorption of base plates. The suggested changes were subsequently adopted by Committee C-7 and will appear in the 1928 *Proceedings* of the society.

The specification C51-24T, "Tentative Definitions of Terms Relating to Lime," having been tentative for two years without revision, was recommended to the society for advancement to standard and was accepted on this basis.

During the past year considerable interest has been manifested by various organizations looking toward the establishment of plastering specifications which would demand national recognition by all interested parties, including producers, consumers, groups producing materials to which plasters are applied, groups responsible for the execution of the work, and groups representing financial institutions.

To offset the disadvantages which may develop by the establishment of several independent plastering specifications, which would only tend to confuse the main issue, it would seem desirable to cooperate in some manner whereby the resulting regulations would be of widespread importance.

Committee C-7 has given serious thought and study to the several methods proposed for joint committee operation for drafting such specifications, at each of its three meetings, and a recommendation representing the opinion of this committee is expected in the near future.

Committee C-11 on Gypsum

By Henry J. Schweim, Secretary

COMMITTEE C-11 on gypsum has held three meetings during the year 1928. Considerable discussion has been had on the advisability of a standard plastering specification. The committee is unanimous in its belief that a specification covering the mixing and application of plaster to the bases or backgrounds commonly employed in building construction would eliminate lots of the evils of plastering. While a specification governing application of materials cannot be issued as an A. S. T. M. Standard, it is hoped that the society can cooperate with other interested bodies in the formation of such a specification.

There has been considerable work done on the results of various forms of calcium sulphate as a retarder for portland cement. E. E. Berger, of the Bureau of Mines, New Brunswick Station, has been very active in this work. An article by him covering the results of his experiments up to date appears in the December 8 issue of Rock Products. Another interesting article on this subject, by Richard K. Meade, appears in the November 24 and December 8 issues of Rock Products.

The Bureau of Standards has cooperated very generously with Committee C-11 and conducted a series of tests to determine the crushing strength and modulus of elasticity of gypsum fiber concrete. Two kinds of gypsum were used in the investigation. Gypsum I, a high consistency stucco, and Gypsum II, a low consistency stucco. The following mixes were employed, the first figure being the percentage of gypsum, the second the percentage of shavings, and the third the percentage of water, all percentages being by weight:

GYPSUM I	
100-0-60	100-0-70
97-3-60	97-3-70
90-10-70	90-10-80
87.5-12.5-70	87.5-12.5-80
GYPSUM II	
100-0-50	100-0-60
97-3-50	97-3-60
90-10-60	90-10-70
87.5-12.5-60	87.5-12.5-70

The results of these tests can now be prepared for publication by the Bureau of Standards.

The tentative specification for gypsum molding plaster, C59-26T, and tentative specification for gypsum pottery plaster, C60-26T, having been tentative for two years and no comments or criticisms having been received during that time, it is recommended that they be advanced to standard.

The present standard methods of testing gypsum and gypsum products, C26-27, require the use of the Southard viscosimeter for determining normal consistency of calcined gypsum. Because of the ease with which the modified Vicat apparatus can be operated, cleaned and prepared for another test, the committee is investigating the advisability of substituting the modified Vicat apparatus for the Southard viscosimeter.

Committee C-9 on Concrete Aggregates

By Stanton Walker, Secretary

COMMITTEE C-9 on Concrete and Concrete Aggregates of the American Society for Testing Materials is engaged in carrying out an unusually ambitious program of work for the coming year. The committee, which consists of over 60 prominent engineers, has had only one meeting since the close of its last year's work and, while no final reports have been made, specific objectives have been selected and definite recommendations should be forthcoming at the time of the spring meeting.

The personnel of the committee is divided into seventeen different sub-committees, to each of which is assigned several specific problems dealing with the various phases of concrete and concrete aggregates. Among the more important projects which are being considered by the committee may be mentioned:

Preparation of specification covering mixing, conveying and placing of concrete.

Review of data on flexural strength of concrete with a view to determining if present methods of designing mixtures for compressive strength can be applied to flexual strength.

Standardization of method of making transverse strength tests of concrete.

Development of apparatus for measuring workability of concrete.

Correlation of methods of making abrasion tests on stone, slag and gravel.

Determination of relation of shape of particle of aggregate to the cross-bending and compressive strength of concrete.

Determination of the suitability of stone and slag sand as a fine aggregate.

Study of effect of various extraneous materials, such as coal, lignite, alkali, shale, etc., on concrete with a view to fixing definite specification limits.

Studies of curing of concrete.

Studies of admixtures.

Recommendations for apparatus and methods of testing for determination of deformations in concrete.

Studies of factors affecting the durability of concrete.

Preparation of definitions of terms used in connection with concrete aggregates.

It is expected that the committee will have definite reports of progress on the projects listed above ready at the time of the next meeting, about March of the coming year.

Officers of the committee are Cloyd M. Chapman, chairman, P. J. Freeman, vice-chairman, and Stanton Walker, secretary.

Highway Research in 1928

By R. W. Crum

Director, Highway Research Board

RESEARCH into practically all phases of highway building and highway transport has continued during the past year.

Probably the most significant feature of the year's activity in highway research is the focusing of attention upon important problems. Highway improvement finance, especially in connection with the vast mileage of farm roads, economical types of surface for the light traffic roads, handling of traffic in congested metropolitan areas, causes and prevention of highway accidents, mixing of concrete, curing of concrete slabs, maintenance of concrete roads and bituminous materials for low cost roads, are questions in need of intensive study.

The Highway Research Board is pleased to announce that arrangements have been completed for conducting a special correlation investigation on the "Curing of Concrete Pavement Slabs." It is the plan at first to study all available data bearing upon this problem. These data will be analyzed and submitted to a special committee. The further program of this investigation will depend upon the findings of this committee. Active prosecution of the work only awaits the appointment of an investigator to take charge of the work and the organization of the special committee.

A principal function of the Highway Research Board of the National Research Council, is to collect, correlate, and disseminate the results of the work in this field. The *Proceedings* of the Seventh Annual Meeting of the Board which were published during the year, were principally devoted to summarizing the existing knowledge coming within the scope of the board. The topics covered in this publication are as follows:

Causes and Prevention of Highway Accidents:—"Highway Accident Statistics," "Present Status of Headlight Regulation." "Color and Form of Traffic Signals and Signs," "A Survey of Accidents Involving Trucks at Hartford, Connecticut," "A Method of Measuring Relative Efficiency of Traffic Flow Through Street Intersections" and "The Railroad Grade Crossing Hazard on Rural Highways."

Structural Design of Roads:—"Motor Truck Impact Studies," "Subgrade Studies," "Low Type Roads," "Sand-Clay and Top Soil Roads," "Bituminous Pavements," "Portland Cement Concrete Pavements," "Curing Studies," "Fatigue of Concrete," "Stress Measurements," "Reinforcement" and "Studies of Brick Pavements."

Materials:—The factors involved in control of concrete, "Portland Cement," "Fine Aggregate," "Coarse Aggregate," "Design of Mixtures," "Curing" and "Tests on Finished Concrete."

Highway Traffic Analysis:—Analysis of various problems, "Capacity of Traffic Lanes," "Time Losses Due to Crossings, Villages, By-pass Routes, Curves, Hills, etc.", "Future of Common Carrier Transport on Highways," "Estimating of Traffic," "Study of Traffic by Aerial Photography," and "Traffic Flow Recorder."

Maintenance:—"Gravel and Stone Roads," "Bridges," "Snow Removal Equipment," "Causes and Cure of Frost Boils."

Culvert Investigation:—Method for estimating probable life and economic value of corrugated metal culverts.

The report of the Low Cost Road Investigation which has recently been published contains descriptions of practically all of the methods used in the United States for building the lower types of roads, with thorough discussion of materials, construction and maintenance methods and costs.

The report and papers of the Eighth Annual Meeting of the Highway Research Board, held in Washington on December 13 and 14, 1928, present the latest developments and call attention to many unsolved problems. Among them are:

"Financing State Road Systems with Bonds" by T. H. Cutler, and "The Pay-as-You-Go Plan of Highway Financing" by J. T. Donaghey. These papers present the fundamental considerations that must be taken into account in planning for highway improvements. Experiences are now available in many states which should furnish facts to establish the relative importance of these fundamental factors.

The report of the Committee on Highway Traffic Analysis deals principally with the problems of traffic control in congested areas. Also "Traffic Conditions in Cleveland" by J. G. McKay, and "Aerial Traffic Surveys" by A. N. Johnson.

"The Personal Factor in Highway Accidents" by Sidney J. Williams. The National Safety Council has in progress important research work on the relation of personalities to accidents.

"Research on the Mixing of Concrete," by A. N. Talbot. Several other factors are found to be as important in mixing concrete as the length of mix.

"Concrete Pavement Maintenance" by Lee S. Trainor. The protection of cracks and joints in concrete pavements is a difficult problem to the maintenance engineers.

"Use of Excess Fine Aggregate in Concrete Pavement," by C. N. Conner. The exigencies of material situations often require the development of methods for the use of unusual combinations of aggregates.

"Application of Research to Rigid Pavement Design," by Committee on Structural Design of Roads. "Spacing of Dowels and Cross Section Design" by H. M. Westergaard, "Contraction and Expansion Joints" by A. T. Goldbeck, "Control of Cracking" by L. W. Teller, and "Reinforcement" by C. A. Hogentogler.

"Application of Present Knowledge in the Construction and Maintenance of Bituminous Macadam and Bituminous Concrete," by G. H. Henderson.

Activities of the Bureau of Mines in 1928 in Major Nonmetallic Industries*

By J. R. Thoenen
Mining Engineer, U. S. Bureau of Mines

RECOGNIZING the important part played by economic factors in the success or failure of operations designed to exploit the earth's raw materials, the Bureau of Mines during the past year expanded its organization to carry on studies of such factors.

For various reasons expansion along new lines is necessarily slow. Nevertheless some progress has been made, and readers of ROCK PRODUCTS may be interested to learn something about some of the activities of the building material section of the Bureau.

Studies of Quarry Costs

Late in 1927 a representative group of quarry operators requested the Bureau of Mines to conduct a study of quarry-operating costs. The object of the inquiry was first to determine the actual cost of each of the various operating steps in the production of stone, and then, from a study of these data, to evolve a possible standard form of cost keeping.

The difficulties of making direct comparisons between operations so diverse in their nature were fully recognized, but it was thought possible to accumulate and group returns from a large number of quarries so that averages could be struck that would present interesting and instructive comparisons.

Early in 1928 extended questionnaires were sent to 1700 quarries throughout the United States. Owing to the pressure of other matters, these unfortunately did not reach the operators until the busy production season had started, so that delay in sending in the returns was occasioned. As the compilations will not be complete until all returns are in, the final results cannot be made known for some time yet. At the request of the National Crushed Stone Association, however, preliminary compilations have been made of the replies received up to November 1, but it was necessary to limit the study to limestone, as representing the largest group.

Preliminary tables have been compiled to show average total quarry costs by groups on the basis of the use to which the material is put, such as for lime, crushed stone, rip rap, cement, etc. Other tables show the costs of operations in the various steps of quarrying by differing methods. For instance, the table covering stripping costs compares the various methods of removing the overburden, the drilling table shows piston, hammer, and well-drill costs and so on. The stripping table also shows average values for other contributory factors which have a bearing on the costs, such as length of waste haul and method of transportation.

These tables follow the quarry operations through blasting, loading, transportation, crushing, conveying, elevating, screening, drying and storage, showing costs for various groups under each heading.

Results of this preliminary study will be presented at the annual meeting of the National Crushed Stone Association at Cleveland in January, 1929. It is hoped that all interested operators will study these tables and make suggestions as to other details that should be brought out in the final compilations.

The figures presented in the tables must not be considered final, for they are subject to correction in accordance with later data. They are presented merely to give operators a chance to familiarize themselves with the intent of the cost study, the method of compilation, and presentation of results, and to offer their criticisms.

Economics of Opening New Sand and Gravel Deposits

The phenomenal growth in the production of sand and gravel during the past five years is evident to anyone familiar with the industry. A possible and probable result of such rapid expansion in any industry is the promotion of new projects without adequate study of economic conditions. Any industry, considered nationally, may expand wonderfully in a short period of time, and from this viewpoint only the aggregate benefit is seen. On the other hand, the local aspect may be entirely different. Intense competition may be a real obstruction to progress in a limited locality. The local aspect is the point of view from which new developments should be considered. The ease with which sand and gravel deposits may be exploited greatly facilitates expansion. The failure of new enterprises not only means bankruptcy to the individual, but has a demoralizing effect on the industry as a whole.

The Bureau of Mines has compiled in condensed form a discussion of the conditions which should be carefully studied by the individual before opening new sand and gravel projects. This compilation is now in press as an economic paper. In addition to the presentation of the economic factors involved, graphs are presented showing the production by individual states by years since 1907. There is also included a comprehensive bibliography which will direct the interested reader to further sources of information.

Potash from New Jersey Greensand

The glauconitic marls of New Jersey have long been known to contain potential supplies of potash suitable for fertilizer. However, up to the present time no extraction process has been exploited with commercial success.

A study was undertaken to ascertain what the economic possibilities were in potash extraction from these marls. The preliminary study was confined to three processes representing rather divergent methods, such as digestion with milk of lime and acid extraction together with the manufacture of by-product brick, cement or other materials. Having no operating cost data on which to base calculations, the first objective sought was a balance between the raw materials cost and the receipts from manufactured products. Each chosen process was subjected to such an analysis with due consideration given to freight rates, size of operating plant unit, etc. The difference between these sets of figures must necessarily cover all operating costs and profits or the process must be deemed economically unsuccessful. This preliminary report has been completed and cost limits established for the processes studied.

A supplementary study is now in progress with the object of ascertaining whether the cost limits as previously determined are sufficient to indicate a possibility of their covering operating expenses.

In this secondary report conclusions are being reached by a study of costs of comparable operations in other industries, and of equipment and operating costs as obtained through the co-operation of manufacturers. Various alternative operating methods are being considered, and resulting cost calculations will be presented as ranging within certain limits, depending on the method involved.

Program for the Future

The building materials section of the Bureau of Mines has recently started an economic study of conditions requiring analysis prior to the opening of new quarry operations; this study is similar to that just completed for sand and gravel. The plan is later to expand both these subjects so as to present the economic situation, past and present, with respect to the production of the various kinds of sand, gravel and stone, such as glass

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and molding sands, ballast and aggregate gravel, and the various types of crushed stone classified according to uses.

The graphs for annual production of sand and gravel by states do not tell the whole story. One state may produce a major portion of the output of a high quality special sand commanding a higher market price than the sand of its neighboring state, which may produce only the lower grade materials. Obviously, comparisons in such cases lead to erroneous conclusions. It is hoped that by presenting the economic picture for each subdivision the results will be clarified. It is true that one cannot prophesy with accuracy what will happen in the future by what has occurred in the past, nevertheless such recapitulations serve a useful purpose in furnishing warnings and indicators, and often presage certain trends.

Much is heard of "profitless prosperity." Individuals in many industries assign this condition to overcapacity or overproduction. It is the writer's desire, with the co-operation of the various nonmetallic industries, to ascertain just what relation the country's capacity to produce a certain commodity has to the actual production.

In addition to the work described, other studies are contemplated, but they have not yet reached the presentation stage.

The foregoing studies deal with special or specific problems only. However, for consultation in replying to the constantly increasing volume of inquiries reaching this office, information files are being built up continually on all nonmetallic subjects. These files are already quite extensive and cover a wide range of subjects. Inquiries are solicited, and it is especially desired that the interested industries offer suggestions for research. This phase of the work is considered in the nature of continuous service and can only be expanded in co-operation with industry itself, which in the last analysis is the object sought.

Talc and Soapstone

TALC AND SOAPSTONE production for 1928 apparently was 5% greater than 1927, with prices about the same. For the last four years the total value of these minerals has shown slight increases, but the price per ton remains practically stationary. The indications for 1929 are that there will be a slight increase in total tonnage, as several producers have installed additional grinding and sacking equipment The paint, paper and roofing industries absorbed a large percentage of the total production. No new products were developed during the year, although the new office building of the Loomis Talc Corp., at Gouverneur, N. Y., has some very unusual features using talc and talc compounds in practically every item of its construction.

The talc and soapstone industry as a whole is another rock products industry which needs a real national association to develop new uses and methods of production that will benefit the whole industry. Better grading and a standardization of grading is one of the foremost needs of the industry, judging from the character of the replies we received in answer to the question covering that point.

Industrial news items regarding the industry, while not complete, show the trend of developments. The United States Talc and Crayon Co., Glendon, N. C., rebuilt its plant which was destroyed by fire in 1928. Gerheardt Bros., Asheboro, N. C., are planning on erecting a pulverizing plant at their deposit on Soapstone Mountain. Skagit Talc Mining and Refining Co., Seattle, Wash., is to build a two-mile tram for handling talc from its mine at Sedro-Woolley to the railroad.

Three incorporations were reported, totaling $1,150,000, with one listing stock as of no par value. The largest of these incorporations was that of the Garner Electric Range Co., Spokane, Wash., which proposes to develop talc properties in Idaho.

One of the notable plants built during the year was that of the Blue Ridge Talc Co., at Henry, W. Va., and which was described in the October 13 issue of ROCK PRODUCTS.

Fuller's Earth—Clays

FULLER'S EARTH is used as a filtering medium in clarifying or bleaching fats, greases and mineral oils. Its occurrence is fairly evenly divided over the United States and the deposits that have been commercially developed are those close to the larger oil fields, notably Texas and California. Southern California, especially the Mojava desert region, is literally spotted with a commercial grade of fuller's earth suitable for most oil clarifying purposes, and for that reason the product has a very low value in that section. Several property owners have reported that they were unable to sell any of their material at a price that would show a possible profit.

In other sections of the country prices are more favorable, as can be seen from the following table taken from "Mineral Resources of the United States, in 1927":

Year	Operators reporting	Short Tons	—Value of Mines— Total	Average
1923.....	15	149,134	$2,247,523	$15.07
1924.....	13	177,994	2,632,342	14.79
1925.....	14	206,574	2,923,965	14.15
1926.....	14	234,152	3,356,482	14.33
1927.....	16	264,478	3,767,038	14.20

The Muldoon Fullers Earth Corp., incorporated at Houston, Texas, for $25,000, and are planning on erecting a grinding mill. The Fullers Earth Co., Midway, Fla., is reported as having a busy years and planning on increasing its capacity 25% in 1929.

TALC AND SOAPSTONE SOLD BY PRODUCERS IN THE UNITED STATES

	Crude			Sawed and Manufactured						Ground			Total		
				Talc			Soapstone								
Year	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Short tons	Value	Value per ton
1923.....	5,706	$50,125	$8.78	682	$114,772	$168.00	22,857	$932,098	$40.75	167,447	$1,915,258	$11.50	196,692	$3,012,253	$15.30
1924.....	5,710	22,247	3.90	846	109,405	129.00	25,630	1,288,885	50.30	171,635	2,095,019	11.75	203,821	3,515,556	19.00
1925.....	5,684	24,533	4.33	895	107,691	121.00	.....	.....	.....	175,677	1,879,569	10.70	182,256	2,011,793	11.05
1926.....	5,988	26,723	4.47	1,528	130,253	87.00	.....	.....	.....	174,052	1,954,018	11.20	181,568	2,110,994	11.50
1927.....	5,706	25,365	4.43	1,494	111,650	75.00	.....	.....	.....	185,116	2,097,709	11.30	192,316	2,234,724	11.60

Compiled from Mineral Resources of the United States (1927).

The new plant of the Blue Ridge Talc Co. at Henry, W. Va.

Survey of Limestone and Phosphate Situation in the Midwest States

By J. R. Bent

Manager of the Limestone and Phosphate Department, Illinois Agricultural Association
Secretary of the National Agstone Association

SPEAKING GENERALLY for the midwest or grain states as a whole, agricultural limestone has continued to receive an increasing recognition of its relative importance to both the limestone quarrying industry and the agricultural industry. In certain areas its production and use have remained about constant as compared with previous years; in other areas some loss in volume has been experienced temporarily, due to local conditions; in still other areas very remarkable gains have been realized.

Aside from the farmers' financial ability to buy, two other factors exert a great influence upon the amount that is used in different localities season by season. One is the type of farming and the other is the weather condition. Agricultural limestone must be applied at certain periods in the year's succession of farm activities. Just where this period falls depends upon the type of farming; and if the weather condition happens to be bad in a given locality at that particular period, agricultural limestone use in that locality suffers for that season.

The Heaviest Limestone-Using Area

Perhaps one of the heaviest limestone-using districts in the country is that of the wheat-producing area embracing some eight or ten counties in Illinois within a semi-circle with East St. Louis as its center. The use of limestone fits in particularly well with the growing of wheat. Wheat should be rotated with clover. Clover needs limestone. The limestone can best be applied immediately following the wheat harvest. The wheat harvest, being a cash crop, furnishes the farmer with the money to buy limestone at the time he most desires to make such purchases. During the winter 1927 and 1928 wheat in the East St. Louis territory was very largely winter-killed, with a result that this important territory showed a material shrinkage in the volume of limestone used in 1928. Notwithstanding the loss of tonnage in this important area, Illinois will probably show an increase over the previous year. Incomplete returns indicate a final total which may equal 750,000 tons, or second only to Illinois' own "first place" record of 800,000 tons hung up in 1925.

On the production side 1928 seems to have been one more year added to the period of several years in which the quarrying industry of the midwest territory, as a whole, has experienced marked activity and high production, resulting in a correspondingly high production of byproduct screenings, which have continued to be the major source of supply of agricultural limestone.

Best Particle Size Still a Subject for Investigation

In specifications as to size of material, there seems to be a continuing tendency for the extreme views to modify somewhat. In states and area where very fine material has been the practice heretofore, there is some interest being shown in some modification toward slightly coarser material; and in states where coarse material has been used—Illinois especially—there has been a tendency toward a demand for, and a corresponding production of, somewhat finer material, especially as to the maximum size of the particles. The quarries in the territory surrounding and tributary to Chicago continue to furnish very largely minus 4-mesh screenings. Some of them are putting out a limited amount of minus 8-mesh as a special size. Quarries of the St. Louis territory are producing a somewhat finer byproduct screenings, and those which are located in Indiana for the most part are meeting the Indiana standard of minus 8-mesh.

Effect of Impurities

During the year the writer has made some investigations at various plants to determine what if any difference there may be in chemical quality found in the various screen "segregates," or various sizes of product from the same plant. Some interesting facts in this way have been brought to light. It has already been recognized that the primary screenings, i.e., the screenings which come from the first screening operation following the primary crusher, are apt to contain more foreign matter—clay, shale, soil, etc.—than screenings from other sizes, or than the screenings from subsequent crushing operations. This is especially true in the case of deposits where it is difficult to strip thoroughly, or in deposits which have horizontal clay or shale seams or vertical fissures.

For several years the writer has advocated a production practice, at quarries of this character, under which the primary screenings will be held separate and disposed of for low-grade purposes such as railroad fill, secondary road dressing, etc., and the agricultural product limited to the secondary screenings taken from the subsequent reduction crushing output.

The new feature which has been brought to light this year, however, is that of a variation in chemical quality of the stone itself found in the various sizes of the product or screen segregates. The character of fracture has a direct relation to the character of the stone. High calcium crystalline stone shatters more readily in the crushing operations and produces a higher percentage of "fines." The dolomitic stones on the other hand seem to be tough and do not shatter so readily.

One of the more prevalent impurities in the stone itself, particularly as regards its value for agricultural purposes, is silica. This impurity occurs in various forms. In the high calcium stone it is frequently found as so-called "flint" in thin beds, lenses or nodules; but in some of the dolomitic deposits it occurs in the fine granular crystalline form. In this form the rock is very brittle, shatters easily, and silica is found to predominate in the finer particles after the blasting and first crushing operations. This is emphasized by the fact that the true stone, being dolomitic, is tough and not easily reduced; as a consequence the primary screenings from such plants show a high relative percentage of silica compared with the coarser screen segregates. In one case recently studied by the writer the ⅛-in. screenings from the plant analyzed 83% calcium carbonate equivalent, whereas the No. 2 concrete size from the same plant analyzed 94%.

These facts should, and the writer believes will, be of interest to the producers as specifications for agricultural limestone become more rigid and methods in both production and use more exact. The practice of discarding the primary screenings, at plants troubled with soil, clay and shale impurities, has been increasing in the last two or three years and the writer believes that the same practice can and will be extended to plants troubled with silica, especially if in the granular form; and it may not be absurd to suspect that even where silica occurs as flint a careful study of the various sizes may show a preponderance of this impurity in some one size, which could be eliminated after the primary crushing, thus raising the grade in the finished product.

High Calcium vs. Magnesium Stone

The consideration of calcium versus magnesium is perhaps not quite so acutely controversial as was true a year ago. Undoubtedly calcium is needed more than magnesium as a plant food, but as a soil acid neutralizer magnesium seems to be showing satisfactory results; and the more recent opinion among scientific authorities seems to be, that in the

soil, magnesium is not so much slower than calcium as is found to be the case in laboratory tests.

The important considerations seem to be the number of particles of limestone and their thorough distribution throughout the soil. It has been recognized for a long time that fineness of grinding increases early availability of limestone both as an acid neutralizer and as a plant food, but it has been assumed that this is due to the increased area exposed by the particles. The latest theory is that each particle in the soil is a nucleus which quickly surrounds itself with a spherical zone of alkalinity in the soil solution; from which no further action can take place until something occurs to move the saturated solution in that zone and thereby bring about diffusion. Under this theory the size of particle and the exposed area are merely incidental in their relation to the governing factors, which are the number of particles and how they are distributed in the soil. Even the type of stone ("high calcium" or dolomitic) thus has less effect. Naturally, the small particles will dissolve and disappear in less time, whereas the larger particles will continue to exist and render some benefit for a longer period. This theory may have a tendency to bring about a somewhat narrower range in the maximum and minimum particles in the agricultural limestone product of the future.

Need Measure of Relative Values of Different Materials

There is real need for some fairly definite and equitable means of measuring the relative value of different agricultural limestone products in order that they may compete equitably in the agricultural market. An attempt has been made to find some basis for establishing a score card, but the problem seems to be complex and difficult. The purpose and value of limestone used on the soil will differ with the soil, the crop, the rainfall and the weather conditions. The character of the stone chemically may range from a true dolomite to a true high calcium stone; also, as already pointed out, the fineness of grinding is an important factor. The problem of standardizing grades, however, should not be given up simply because it is difficult. It is to be hoped that some equitable basis for roughly classifying and even scoring quality in agricultural limestone may be found in the near future.

F.O.B. Destination Prices

In past years there has been no uniformity as to the basis upon which agricultural limestone is priced. Some companies have chosen to sell on a strictly f.o.b. quarry basis; others have sold f.o.b. quarry, but have quoted and guaranteed the freight rate; still others have sold on a delivered basis. This last year (in Illinois particularly) there was a distinct step taken in the direction of most companies pricing on the delivered basis, and as a natural consequence prices prevailing throughout the entire state were more nearly uniform than ever before.

While there are objections both from the purchasers' and from the sellers' standpoint to the delivered price basis, the considerations in favor of it seem to outweigh, at least in the judgment of the producing companies. Some of these considerations are definiteness and simplicity from the farmer's standpoint. He is primarily interested in knowing just what his material will cost him at destination rather than how that cost is made up. The delivered price basis enables the producing companies to extend or restrict their market area as they may have occasion in order to equalize their production volume and sales policies, for in this way, if they so desire, they can sell their surplus farther away at less net return to themselves, without bringing down the net price realized for the bulk of their product sold in their normal territory. On the other hand, the farmer considers this very fact a two-edged sword, so far as his interests are concerned. Under some conditions and in some localities it promotes competition, but in general it has a tendency to increase the net cost to those farmers who live close to some one quarry, but remote from the competing quarries.

In the writer's opinion, stability and uniformity of price, if maintained at a fair and reasonable level from the farmers' standpoint, exert an influence for healthy development in the volume of business; but if the level is considered by the farmer to be too high, even though only slightly so, that very uniformity is offensive to him and therefore damaging in its influence upon the development of business.

There is still another angle which perhaps has not been given due consideration: the railroads in general have displayed a friendly attitude toward the development of the use of agricultural limestone and have reflected their attitude in a disposition to be approachable and responsive on matters of encouragingly low freight rates. This has been particularly true in the middle west and especially in Illinois. It is not uncommon, however, for them to react to a plea for freight reductions here and there, with the statement "we would be willing to do something along this line if we could be guaranteed that it will be reflected directly in the cost to the farmer and not absorbed as so much profit by the limestone producing companies." The answer to this is a very simple one if limestone is sold on an f.o.b. quarry price, for the farmer himself then pays the freight; but on a delivered price basis it is not so easy to convince the railroads that it is the farmer who gets the benefit of any downward freight changes, especially if the tendency is for the delivered price to increase, even though slightly.

Seasonal Differentials in Price

Some quarry companies have followed, during recent years, a policy of "seasonal differentials" in their prices. In other words, they have made a definite temporary reduction in the price they quote during the "off" season (or the period of the year in which the normal demand is very light). Theoretically, this policy would seem to be sound. The farmer who is willing to inconvenience himself by taking his material at a time when he cannot so well use it should be given some financial incentive. Every carload sold in the "off" season relieves to that extent the congestion of orders in the "peak" season, thus benefiting the shipping company and the customers who insist upon their orders being filled in the busy season. The latter customer should appreciate the propriety of his paying a corresponding premium. In practice, however, the effect of an "off" season reduction does not seem to develop any great volume of business.

The indirect cost and loss to the farmer through interruption of his other obligations during the season when he is too busy to use limestone is not adequately offset by the slight saving in the price. Nevertheless the fact that the agricultural limestone shipments are largely concentrated within the period August 1 to October 30, while its production extends throughout a period of nine or ten months, is a serious economic load upon the business; and any plan which would seem to give promise of relieving this troublesome and expensive feature should be given very serious consideration by all parties interested.

More Exact Knowledge on Uses

A very marked development in the last year or two has taken place in the recognition by using farmers of the need for more exact knowledge and methods in the use of agricultural limestone. In earlier years limestone was used without much intelligence or knowledge as to where it should be applied or how much per acre. Today, there is more and more recognition of the importance of measuring the degree of acidity, not only of the farm in general but of each portion of that farm, or field, and applying just enough limestone on each acre to take care of its local need. Also in the past the better farmers considered that they should repeat the use of limestone at a standard rate per acre at regular intervals in their crop rotation plans. Today, the best thought and practice is that use of limestone should not be repeated upon the soil until soil tests indicate that it is again needed.

All of this presupposes, or makes necessary, more scientific knowledge and care in control tests of the soil; a field of endeavor in which the county agricultural agent or farm adviser, functioning through his county farm bureau organization, is rendering, and must continue to render, a very valuable and important service. These more exact methods may tend to lessen the amount used in an extravagant and wasteful way by some farmers, but the economic gains evident from the use of limestone under such methods are so much greater, that the indirect effect has been to increase the number of farmers interested in the use of limestone and the number of acres upon which it has been and will be applied.

Best Results Only With Thorough Distribution

It should be noted in passing, that what has already been said about the importance of thorough distribution in the soil and more accurate determination of the amount and frequency of the application per acre, suggests the importance of improved technique and equipment required in the spreading operations. A number of very good limestone spreaders are on the market, but the writer believes that there is room for further improvement. It is encouraging to note that the subject is being given consideration by farm machinery manufacturers, agricultural engineers and agronomists.

Quarry Storage

Agricultural limestone, being largely a by-product of the crushed-stone industry and produced throughout an operating season of nine or ten months, while shipments are largely concentrated within a period of three months or less, it naturally follows that storage at the quarry is necessary. Many quarry operators are giving much more attention to the problems of storage than was formerly true, but speaking of the industry as a whole, the writer feels that there is still room for improvement in the care exercised by quarry operators in preparing for and protecting the storage pile. The storage space should be adequately drained and protected from in-wash during the wet periods. It should be leveled off and freed from foreign or coarse material, and lastly it should be sufficiently isolated from space to be utilized for the storage of other sizes of stone, so as to thoroughly guarantee against the danger of a mixture of the two sizes.

Piles of different sizes of stone may be sufficiently separate while they are still small, but may avalanche together when the piles grow to maximum size. The writer feels that the average quarry superintendent and foreman is not sufficiently awake to the fact that a very small amount of larger size stone, carelessly allowed to get into an agricultural limestone shipment, may do very great harm to the farmer through breakage of his limestone spreader, causing repair expense and serious delay, and souring him on the shipper.

Winter Shipments

A word regarding winter shipments may be in order at this point. It is probable that many farmers would be glad to buy and spread agricultural limestone during the winter when the ground is frozen and when their other farm activities are at a low point, but they have been very largely prevented from doing so by consideration of the great danger of the shipment freezing in transit. It is prohibitively difficult and expensive to unload a car of limestone that has frozen. Some companies have attempted to meet this by shipping in box cars, but the expensive loading and unloading of such is a serious objection. Other companies which operate their quarries during the winter months feel that they can with reasonable safety ship from current production, for such stone is fairly certain to be reasonably dry.

Stone loaded from covered storage (bins) is reasonably safe, but the volume of such material is of necessity relatively small. On the other hand, material shipped from open storage piles is almost sure to carry so much moisture that should severe cold weather strike the shipment enroute, unloading at destination will be an impossibility. If a plan could be worked out under which railroad companies would establish a fixed charge for accepting such frozen shipments at destination, taking them to a roundhouse to be thawed out, and subsequently unloading them with railroad employes, the way might be open for the producing companies, in co-operation with farm organizations, to establish some kind of an insurance pool under which the purchasing farmer would, for a relatively small insurance premium per ton, be guaranteed safe arrival of his shipment in an unfrozen condition. Under such a plan the writer feels that a considerable volume of winter business could be developed. The matter may be worth constructive thought on the part of the producing companies.

Storage at Destination

Storage at destination in the hands of the dealer, for resale in less than carload amounts, on a merchandising basis, is a service which has helped some, particularly in certain localities, but in general it has never been developed to any great extent, and the reason is perhaps found in the fact that agricultural limestone has been established on such an economically low price basis that there is little or no room in the dealer's margin for items which add to the cost.

The dealer has a function which he is especially qualified to perform. He has the railroad siding, wagon scale, and in general the physical and financial "set-up" for service on the shipment and account. In general, dealers have been disposed to render this service without adequate compensation because of the benefit to the agricultural welfare of the territory they serve; but the dealer is not qualified, situated or given sufficient financial compensation to enable him to function effectively in the development of sales, or to give scientific advice covering the use of agricultural limestone. These latter are functions which the farm bureau can best perform. It is where there is greatest recognition of the co-operative team work, which is possible between farm bureaus and dealers, that there is the healthiest and best situation with reference to the use of agricultural limestone.

Use of Limestone Working Westward

As might be expected, the interest and activity attached to the use of agricultural limestone is gradually working westward. History repeats itself in different states. Iowa, during the last two or three years, has been going through the same experience as Illinois went through some years ago, and other states still farther east went through still earlier. First, there is a recognition on the part of the scientific agricultural authorities of a condition of mild acidity in certain areas within the state. Then follows increased acidity, more general recognition, conviction among the leading farmers that something must be done, the use of limestone in a limited way, realization of benefits, more general use, and finally a wave of rapid development, which may be called the "boom" or "new-boom" period. The development of the tonnage in Iowa has been especially marked and gratifying the last two years. Detailed figures will be found further on in this review. But at the rate of development which has taken place recently, in another year or two Iowa may lead the nation. Already it is a close second to Illinois.

The reasons for this remarkable development may be found, first, in the need of the soil; second, in the fact that Iowa farmers have suffered especially severely in the farm deflation period and through the effects of agricultural overproduction. Iowa farmers realize, therefore, the importance of a lessening of grain acreage and the advantage of including the various clovers or legumes in the crop rotation. A soil sweetened with limestone and with adequate calcium as a plant food is a prerequisite to successful legume growing. The extension authorities of the Iowa agricultural college have played a very important part in the spreading of the limestone-legume gospel in their state. There is a large number of local portable and semi-portable crushing operations in Iowa. These are likely, however, to become less prominent as a source of supply (excepting in territories remote from railroad stations) as large commercial sources of supply become better developed and their sales work better established. The portable plant has its function to perform under certain conditions. Experience will enable it to find and to retain its place.

Agricultural Limestone Still Largely a Byproduct

During the last few years there has been a tremendous building program under way in some of the larger cities. This has been markedly true in Chicago, and has been true also in St. Louis and in smaller cities. It has resulted in several years of activity for the crushed-stone industry, and this has been greatly augmented by the hard road program which has been under way in Illinois and Indiana, and is now getting well under way in Iowa. This has all had a very direct and a very great bearing upon the production of byproduct screenings for sale as agricultural limestone. Some new commercial quarries have come into existence, others that have never been interested in the agricultural limestone business have taken an active hand therein during the last year or two, and the result today is that there are many more sources of supply than was formerly the case.

The increased production has fully met the increased demand throughout the midwest territory as a whole, but the practice of more careful selection and culling of the available material has tended to prevent, or at least to lessen, what otherwise might have been a very serious over-accumulation at this time.

Looking ahead, it seems probable that with the hard road program in Illinois well past its high point; with the building program already beginning to taper off in the larger cities, and with the classification and selection of agricultural stone on a more rigid quality basis, the production of crushed stone, and therefore the available volume of agricultural stone supply, in the next two or three years, will be relatively less; while with a realization of the hoped-for gradual return of agriculture to a normal status, the demand should grow. It therefore may transpire that, before long, direct production by use of pulverizers or rolls will become more generally necessary.

The grain belt farmers' financial status during the past eight years has been a very serious obstacle to the development of the use of limestone, but quite as important in this regard as his lack of funds is the farmer's pessimistic state of mind. If and when better conditions begin to return, it is probable that the beneficial effect upon the farmer's psychology will stimulate his disposition to buy limestone before the direct effect upon his financial status has been greatly realized. The one factor which continues to increase, whether times are good or bad, is the need of the soil itself. As our midwest soils grow older their need for restorative work through the use of limestone is sure to increase.

Rock Phosphate

The year 1928 has shown a considerable gain in the sale and use of ground rock phosphate. In Illinois, which is the state that uses most of this material, the tonnage in 1928 increased nearly 50% over 1927, and will show the largest figure since 1920. There is evidence of growing interest in this commodity in other states. One reason for the increased interest and use is perhaps found in the marked improvements that have been effected in its production and in its method of use. A few years ago a product 90% of which would pass a 100-mesh sieve was considered very finely ground. Today the leading producers are operating on a specification holding 97% as a minimum on the 100-mesh sieve determination, and most of the product that is now being sold will average about 99% through 100-mesh. There is some possibility that before long the basis for determination of grinding may be a 200-mesh sieve instead of a 100-mesh, for it seems now to be fairly well established that it is the very fine material which gives early results in the soil.

In use there has been a change from the old method of plowing the material under in contact with a clover crop or with animal manure, to the modern method of thorough distribution in the soil. That which has already been said in this article about limestone is even more important in the case of rock phosphate, i.e.: It is the number of particles and their distribution in the tillable portion of the soil that determines early availability. Also there is real need for improvement in the distributing or spreading machinery to keep pace with these changes in method of use. The finer the material, the harder it is to handle and to spread evenly in light amounts. With the present product, earlier and better results are being secured by the farmer with half the application per acre formerly necessary with the coarser material. Thus, while finer grinding has played its part in increasing the cost of production and the selling price per ton, it has made possible decreased amount used per acre, which actually decreased the cost per acre, while increasing the early results. Rock phosphate mined and milled for the purpose of direct application to the soil still is very small in total tonnage as compared with that produced for acidulation (the manufacture of acid phosphate, now known as super-phosphate), but the changes and improvements which have just been cited are giving the natural product growing recognition and a relatively greater development of tonnage, compared with the artificial product.

Acknowledgments

The writer wishes to give grateful acknowledgment to various specialists and authorities in some of the midwest states, other than Illinois, for information courteously furnished by them covering the general situation in their own states respectively. A brief summary of such information, state by state, follows:

OHIO—From Dr. Truman E. Bear, professor of soils of Ohio State University, comes the information that Ohio has seen very little change in the tonnage of agricultural limestone used this year as compared with 1927. The interest is somewhat on the increase. There has been very little change in the sources of supply. Dr. Bear thinks that the tendency is toward finer material; which material is costing from $3.25 to $3.50 per ton delivered, with an extra charge of $1.50 per ton if the material is furnished in sacks. Local portable crushing outfits are used very little in Ohio. Dr. Bear thinks that the general outlook ahead is a little better. Very little ground rock phosphate is used in that state. Most of the phosphorus applied to the soil is in the form of super-phosphate. There is, however, a little in the form of super-phosphate, treble-super-phosphate and commercial fertilizer. There is some little interest, however, being developed in the use of ground rock.

MICHIGAN—Prof. George M. Grantham, research associate in soils, Michigan State College, says that agricultural limestone has experienced a decided increase in 1928, both in use and in the interest displayed. No new sources of supply have been developed within the state, but a greater number of companies outside of Michigan have participated in the sale of agricultural limestone to the farmers of that state. There has been little change in specifications as regards fineness, but he believes that the general tendency is toward somewhat coarser material than has been the practice heretofore in that vicinity. Selling prices have remained fairly constant, about $2.25 per ton delivered, for medium ground stone. Portable crushers do not seem to be a factor in Michigan. The general outlook in Michigan for next year is excellent. Prof. Grantham says that very little natural rock phosphate is used, though super-phosphate is used quite extensively.

INDIANA—Prof. M. O. Pense, associate in soils, Purdue University, Lafayette, Ind., writes that the tonnages of Indiana have not yet been compiled, but he believes that the figures will be somewhat larger than was the case for 1927. Interest among the farmers is very much on the increase. Hillside marl is being used quite extensively in southeastern Indiana in some ten or twelve counties. There has been very little change, according to Prof. Pense, in the specification as to fineness of grinding. He states that the material mostly being used is minus ¼-in. Prices have not changed much, though there may have been a slight tendency to increase. Present prices will range from $1.60 to $2.40, delivered. Portable crushers are used to some extent in the territory, which has available deposits, but is remote from railroads. Prof. Pense thinks that more limestone will be sold next year than in any previous year in Indiana. Comparatively little natural rock phosphate is being used, according to Prof. Pense. The state, however, does use a fairly large amount of super-phosphate.

KENTUCKY—Prof. George Roberts of the University of Kentucky was unable to quote figures for his state, as reports had not been received at the time of his writing.

MISSOURI—Prof. O. T. Coleman, extension assistant professor of soils in Missouri, states that agricultural limestone will show probably about 20% increase in the amount used in 1928 in that state as compared with 1927. There is an increasing interest among the farmers. A few new sources of supply have been developed both of the larger commercial class and also of the local portable type. The latter type of production is showing considerable increase, especially in territory having suitable deposits but located four miles or more from a railroad. With the increasing use of agricultural limestone there is a tendency to be more careful about grade and to require somewhat finer grinding than formerly. The price shows reasonable quality material will run from $1.00 to $1.50 f. o. b. quarry. Professor Coleman thinks that 1929 should show a material increase. Very little rock phosphate is being used, but super-phosphate is being used to considerable extent, also a limited amount of high analysis mixed fertilizer.

WISCONSIN—According to Dr. Emil Truog, professor of soils at the University of Wisconsin, agricultural limestone has shown about a 25% increase in 1928 over 1927. The interest among the farmers has increased decidedly. There have been few if any changes or increases in the sources of supply. The tendency is toward more finely ground material; some kiln-dried material is being used. Prices range from $1.65, f.o.b. quarry, in the summer months, to $2 and $2.10, f.o.b. quarry, in the winter months. These prices do not reflect much change in the last couple of years. Portable crushers are used quite extensively and their use seems to be on the increase. The outlook for the coming year is for increased activity in agricultural limestone. Not much natural ground rock phosphate is being used, but the amount seems to be on the increase. Between 5000 and 6000 tons of super-phosphate in one grade or another has been used during the past year.

IOWA—The report from Iowa comes from Prof. J. L. Boatman, extension associate professor of soils at the state college of agriculture at Ames. Mention has already been made in the body of this article concerning the remarkable development in the use of agricultural limestone in Iowa. Prof. Boatman thinks that the figures may run around 600,000 tons in 1928. There is great interest among the farmers. One or two new commercial quarries have started and a number of new small portable crushers have been established by the farmers themselves in the various territories. In all, there were 197 such crushing outfits in use in Iowa during 1928. The crude byproduct screenings of the commercial plants have been subjected to rescreening or cleaning operations and some have been passed through additional pulverization processes. Prices remained about stationary, varying according, to territory, from 75c to $1.50 per ton at the quarry. Prof. Boatman thinks that the demand for limestone will continue to increase, especially if farm conditions improve. He says that the amount of rock phosphate is small, but the volume is increasing each year. Some phosphatic carriers in the so-called soluble form (super-phosphate, etc.) are being used in the state.

NEBRASKA—D. S. Gross, extension professor of agronomy at the state university, Lincoln, Neb., advises that very little limestone is being used in that state. This is also true of phosphatic fertilizers.

Missouri Velo Cement Plant Producing

THE NEW PLANT of the Missouri Portland Cement Co., St. Louis, Mo., adjoining the older plant at Prospect Hill has been completed and is in operation. This plant makes quick hardening cement and has a capacity of about 2000 bbl. a day.—*St. Louis* (Mo.) *Globe Democrat.*

Review of the Agricultural Limestone Business in Ohio for the Year 1928

By W. H. Margraf
Secretary, National Agricultural Limestone Association

IT IS JUST A TRIFLE early for a full review of the agricultural limestone business in Ohio for the year 1928, but the consensus of opinions of the biggest producers of this product show a shortage of about 20% compared with the tonnage of 1927 for the first ten months. However, that does not mean that the tonnage of the state will show a 20% loss, but merely that the business is divided more this year, due to more producers manufacturing agricultural limestone, who did not produce an agricultural liming material last year. These newer companies have not reported their tonnages so far this year, but from all reports available the total tonnage will be slightly less than last year's tonnage of a little over 200,000 tons.

Fine Material in Bags in Demand

It is interesting to note the trend of orders for finely pulverized limestone in paper bags. Up until the last few years the Ohio farmer was content with bulk shipments of ground or pulverized stone in box or open-top cars, but recently a growing number prefers the convenience of the bagged product, and this preference has also turned the buying farmer to the more expensive, but quicker acting hydrated lime, as a number of hydrated lime producers are reporting a slight gain in tonnage.

Although the bagged business is growing, the bulk shipments predominate in the tonnage, and the farmer, with co-operation of neighbors, can be seen in the spring and fall hauling this material to his fields, where it is piled in convenient piles in the field and spread upon the land.

Farm papers, soil extension departments, agricultural departments of railroads, and limestone companies are continually broadcasting the fact that limestone under the ground does not have the beneficial effect of limestone spread on the soil.

Railways Aiding in Education

In a recent check-up along this line by a railroad company which is educating the farmers in the use of liming materials—first by folders, second by hauling demonstration carloads of material (furnished by quarries on their lines) to various points, where the farmers receive the agricultural limestone gratis and haul it to farms where tests are run on various crops, and third by soils testing trains, where farmers can have soil tested for acidity and hear lectures—wherever programs of this nature are held, increased use of liming material is noted; and a check-up where all three programs were followed in a community, an increase of 325% in the use of liming material has been noted.

In closing, the reports of limestone producers show an increase in tonnage during the spring shipping season over the spring of 1927, with a dropping off of orders during the past fall season as compared to the fall shipping season of 1927. But I feel certain that when complete reports of shipments are received from all producers that the tonnage for the year 1928 will nearly equal that of 1927.

Mica

THE MICA INDUSTRY, considering the value of the tonnage, was marked by the number of incorporations filed during the year. Five companies were recorded with a capitalization of $850,000 and of this total two companies registered their stocks as of no par value.

The Franklin Mineral Products Co., Franklin, N. C., is reported to be erecting a new grinding plant.

A new mineral of the mica family was discovered at Libby, Mont., several years ago, but did not become of industrial interest until 1928. This mineral, vermiculite, is found associated with asbestos and the former, when heated to a moderately low temperature (200 to 600 deg. F.), has the remarkable property of swelling to something like 17 times the original volume, and at the same time the color of the micaceous material changes from a deep brown to a gold color. The product resulting from the heating process is a light, fluffy product and is said to be stable with high insulating values.

To develop this mineral the Vermiculite and Asbestos Co., of Libby, Mont., was formed and is now erecting a calcining plant to treat this material. The Zonolite Co., also of Libby, is developing plans to refine this same product, intending to use it as a base for a wallboard as well as for general insulating purposes. As neither of these concerns are on a production basis yet, the statistics given do not include these minerals.

	Sheet Mica			Scrap Mica			Total		
Year	Lb.	Value	Per lb.	Short tons	Value	Per ton	Short tons	Value	Per ton
1923....	2,063,179	$311,180	15.1c	8,054	$129,695	$16.12	9,086	$440,875	$48.50
1924....	1,460,897	212,035	14.5	4,709	87,242	18.50	5,439	299,277	55.00
1925....	1,793,865	321,962	17.8	9,695	173,537	17.90	10,592	495,499	46.90
1926....	2,172,159	400,184	18.5	7,043	136,643	19.40	8,129	536,827	66.00
1927....	1,512,492	212,482	14.0	6,280	110,139	17.58	7,036	322,621	45.80

Thirty-three companies were reported as producing mica in 1927.

The Phosphate Rock Industry in 1928

By James A. Barr
Chief Engineer, International Agricultural Corp., Mt. Pleasant, Tenn.

THERE has been an average improvement in farm conditions during the year. While there were some setbacks, like a poor winter wheat crop in some sections, this has been offset by much better crops and favorable prices in others. These facts have resulted in a healthy movement of phosphate, with a firmness of prices. Some fertilizer plants report considerable carry-over of manufactured stocks, but conditions as a whole are better in this branch of the industry.

There is a good demand for the higher grades of phosphate rock, with lower grades somewhat slower, but better than last year. The general increase of grades of fertilizers as a result of education of the farmer is responsible for the increase of quality and grade of fertilizers.

The outlook for phosphate rock producers during the coming year is very good, especially for those supplying the higher grades.

The gradual exhaustion of higher grade deposits of phosphate rock has not only brought about an increase of the production of phosphoric acid using lower grades of rock at source, but has stimulated research in various methods of using lower grades of phosphates in the production of phosphoric acid or conversion to concentrated fertilizers. The Bureau of Soils is engaged in investigating the pyrolytic or heat methods as well as the wet methods of the manufacture of phosphoric acid. To date they consider the latter processes as offering the greatest hopes. The Bureau of Mines is confining its research to concentration methods, with the idea of eliminating the impurities from the low grades and turning out a high-grade phosphate.

The general idea of the pyrolytic process is the fluxing of the lime content of the phosphates with silica and the following reduction of the phosphorus with coke or some form of carbon. The liberated phosphorus is combined with water vapor to form phosphoric acid, which is collected as a fairly pure water-white end product in Cottrell precipitators. While the process is nominally exothermic the losses in present methods require the application of external heat in some form of fuel or electrical energy.

In the wet or acid method the ground phosphate is treated usually with sulphuric acid to form a solution of phosphoric acid which is separated from the gypsum residue by filtration or decantation. Impurities like iron and alumina pass into solution as phosphates. Equation:

$$Ca_3(PO_4)_2 + 3H_2SO_4 + 6H_2O = 2H_3PO_4 + 3(CaSO_4 \cdot 2H_2O)$$

Ferro-phosphorus is also produced by smelting phosphate rock in a blast furnace with iron ore and fluxes. The phosphorus is reduced and collected in the iron. Some is also produced as a by-product in the electric furnace used in phosphoric acid manufacture.

Research is general among the various companies and some marked improvements in processes should result from the combined efforts.

Florida Pebble Field

Florida supplies the bulk of the phosphates produced in the United States, with the greatest percentage of this supply credited to the pebble district, of which Polk County is the center. Owing to keen competition, pebble production is essentially a large-volume, low-cost operation.

The sand-clay overburden is stripped by hydraulic methods or by large dragline excavators and the underlying strata of pebble matrix is mined with a hydraulic monitor, followed by very heavy centrifugal, motor-driven pumps, which in turn discharge through pipe lines, into modern steel washers. At the washer the matrix is pugged in logs (log washers) to elutriate the clay and allow the separation from silica grains in following vibrating screens. One millimeter is about the lower limit of screening separation, below which opening the silica grains are about the same size as the phosphate. At present the various companies are actively engaged in testing out various makes of vibrating screens, to secure more efficient separation and lower operating costs.

The finished product from the washers is hauled to a drying plant, where oil-fired, direct-heat, rotary dryers reduce the moisture from 14% to 16% to 1½% or less. There has been little change in drying practice in years, but lately new dryer designs are being investigated with the idea of finding the most economical length, diameter and style of oil burner. The dried product is loaded through elaborate storage and grading systems into box cars or covered hopper cars. The latter are used for port shipment.

Florida Hard Rock Field

This activity centers about 100 miles north of the pebble field. Here the operations are smaller and somewhat different. The deposits are spotty and mining is often done by dredges and the overburden is removed by hydraulicking. The washers include crushers, logs, screens and picking belts. The washed product is mostly shipped to Ferandina for drying and transshipment. There has been increased activity in this field.

Tennessee Brown Rock Field

There has been a good year, with full production and a good demand. High-grade rock is scarce and will continue to be more so. There is a very good and increasing demand for furnace lump, with smaller production. Next year should see higher prices for this grade.

These deposits are the result of leaching and weathering of the Bigby phosphatic limestone. The overburden is stripped by steam draglines and mined by the same machines as well as by hand methods, especially where the phosphate occurs in pockets in the limestone.

The washing problem is, like in Florida, to pug the mine-run phosphate in logs to elutriate the clay, but here the similarity ends, for the main object is now to separate

From mine to finished product, at the Wales, Tenn., plant of the International Agricultural Corp., showing the brown rock phosphate mines, the washer, drying plant, phosphoric acid plant, and also the section for manufacturing trisodium phosphate, and other phosphate products

the clay, in which screening plays a minor part and classification and agitation the main role. Drying is done in coal-fired, direct-heat, rotary dryers which reduce the moisture from 18% or 20% to 1½% or lower. The dryers have a nominal capacity of 12 to 15 tons per hour.

New Construction

Armour and Co. have erected a plant for the production of phosphoric acid and multiple superphosphate directly at their mine near Columbia, Tenn. This is the second plant to be located at a Tennessee mine. The Victor Chemical Co. has nearly completed a blast furnace for the manufacture of phosphoric acid at its Nashville plant. This is a radical departure from the usual pyrolytic process, which has previously been confined to the electric furnace. The Charleston Mining Co. has erected a new two-dryer unit for drying mine-run phosphates for furnace trade. The International Agricultural Corp. has recently completed a new washing unit of creosoted timber to take the place of an older and less modern washer.

Tennessee Blue Rock

There is only one active mine, which is operated by the Charleston Mining Co. at Gordonsburg. Here the phosphate occurs in a relatively thin stratum between overlying shale and a "Leipers" limestone floor. It is mined underground by the well-known room and pillar system. It requires crushing and drying before shipment.

Tennessee Ground Rock

There has been a considerable increase of production during the year of very finely ground phosphate for direct application to the soil, with shipments mostly into Illinois. The fineness specifications require that plus 99% pass a 100-mesh screen and consequently 85% or more will pass a 200-mesh. This extreme fineness requires much care in preparation, which is effected in roller mills with air separation.

Western Fields

Anaconda still continues as the only producer of importance. The bulk of its product is a multiple superphosphate with 42% to 44% soluble P_2O_5. As mentioned in previous articles, the wet sulphuric acid methods are used. Sulphuric acid is produced as a byproduct from ore roaster fumes. Some concentrated acid is shipped in tanks and some ammonium phosphate is produced.

Other known deposits in the United States, located in the Carolinas, Kentucky and Arkansas, are inactive. There is a development contemplated in British Columbia, by a smelting company, with the idea of using local deposits of phosphate and treating them with sulphuric acid produced in a nearby smelter.

Fine Ground Rock Phosphate in Agriculture

Increased Use of Rock Phosphate in Agriculture Has Developed New Product and Projects

WITH INCREASED KNOWLEDGE and experience gained from intensive researches, several of the Tennessee phosphate producers have developed a "new" fertilizer—new in the sense that they have learned how fine to grind the product, new in its scientific application to the soil. This new product is nothing more nor less than the old idea of ground rock phosphate applied directly to the soil, but the product used is ground extremely fine to a uniform fineness, showing a screen analysis of 99.5% through 100-mesh and 82 to 85% through 300-mesh. This rock phosphate is applied "as is" to the soil, especially acid soils, prior to neutralization with limestone. This procedure gives the soil-acids time to react with a portion of the phosphatic material, making some of the phosphate content available for practically immediate use of the plant. Limestone can be added later to advantage to complete the neutralization and any remaining undecomposed calcium phosphate probably will be rendered available later by bacterial and other natural causes.

In the grinding of this material for direct application, the material must be thoroughly dried, as small percentages of moisture have been found to give a non-uniform product. Further, the fine grinding is not only valuable to put the product into such shape physically so that the material will give a large area of attack to the soil-acids, but will also tend to unlock the phosphates that are of inorganic origin from the phosphates that are of organic origin.

Interrogations of producers of both acid and rock phosphate fertilizers seem to show that the question of the value of the phosphate present in the material which came from inorganic sources is of value, but probably not immediately available, and only that which is of organic origin is readily available to plant life. As one producer remarked, "A treatise might very properly be written on the subject."

Some Tennessee producers are now grinding the washed and dried phosphates in Raymond and Fuller-Lehigh mills and shipping the material in 100 lb. cloth sacks. This is a new development in that industry and one company ships a large part of its production in sacks, a procedure that is looked upon with favor by the smaller users.

New phosphate washer at the Blue Grass plant of the International Agricultural Corp.

Some "Experience Records" with Phosphate

Phosphates of either class are necessary for successful farming and the yields, especially of grain crops, are largely increased from its use; in other words, the reproductive portion of the crop is benefited and the crop also matures from 10 to 14 days earlier. Increased yields of from 20 bushels of wheat to 50 bushels per acre are common, and from the financial side, consider the following report of a user:

"Using as a standard 75 cent corn, 30 cent oats and $15.00 for hay, the four fields in the corn, oats, clover rotation,

produced as the five year average when starting use of phosphate, $28.80 per acre. For the four year period including the last application of phosphate, this average on same land was $39.50, or an increase of $10.70 per acre per year with an average application of 3.46 tons of phosphate rock for the entire period, which at present prices would cost $41.52 or $2.77 per acre per year."

The use of phosphates as a mineral hog feed and for chicken grits is another new development, and one company in the Tennessee field is entitled to all the credit for production and marketing of this valuable feed product. This feed is made in four sizes and from phosphatic limestones from several different mines, and these different materials are so blended as to give a grit that will be of uniform phosphate content and of such strength that, when fed to hens, results in a higher egg yield, a more fertile egg, whiter and stronger shells, and also improves the physical condition of the hen. The finer ground material is fed to hogs along with other mash foods and reports are that it is of considerable benefit. Another novel idea is the use of cod liver oil sprayed into the chicken grits, the use of which supplies the hen with certain necessary vitamins.

An interesting development is now in progress in Florida, where the United States Phosphoric Products Corp. is building a gypsum plant using as a source of crude material the residues resulting from the treatment of calcium phosphate with sulphuric acid.

The importation of Moroccan phosphates has seriously affected the Florida fields. The Tennessee and western producers have not felt the results of these imports directly, although there is a certain backing-up effect due to that cause; and the importations, if continued, will disadvantageously affect home producers.

New Plants and Projects

The Summers Fertilizer Co. plans erection of a superphosphate plant at Baltimore, Md. The Standard Fertilizer Co., Inc., Williamston, N. C., is increasing the capacity of its plant and installing sacking equipment. The Davison Chemical Co. has gained control of one of the largest deposits in Florida by the purchase of 239,754 shares of the Southern Phosphate Corp. This company is reported to have built a new plant at Tampa, Fla., this year. The Davison Chemical Co. also purchased control of the Read Phosphate Co., Welch Chemical Co., Columbus, Ohio, and the Porter Fertilizer Works at Atlanta, Ga. The Owl Creek Phosphate Co., Benotis, Fla., started construction of a plant to have a capacity of 200 tons per day.

The Marine Products Corp., Seattle, Wash., is reported to have built a new plant and will get phosphate rock from Idaho. One new incorporation was recorded.

Sand and Gravel Research

By Stanton Walker

Director, Engineering and Research Division, National Sand and Gravel Association, Washington, D. C.

RESEARCHES in the laboratory of the National Sand and Gravel Association at Washington, D. C., are well under way and considerable progress has been made in the six months since the laboratory was established. The laboratory is now completely equipped to carry out the usual tests on sand, gravel and concrete. Included in the equipment is a Southwark-Emery testing machine, having a capacity of 300,000 lb. in compression and 60,000 lb. in tension.

Most of the work which has been carried out thus far has dealt with problems of general interest to the industry, although a number of specific problems have been handled for individual member companies. In what follows is given a brief outline of the investigations which have been completed or which are under way.

The first investigation which was undertaken consisted of tests on the effect of grading of coarse aggregate on its void content. This investigation was considered of fundamental importance, since the void content of the coarse aggregate plays an important part in the economy of concrete mixtures,—the amount of cement required being directly affected by the voids. The tests are also of importance in connection with investigations of the effect of grading of gravel on the compressive and flexural strength of concrete proposed for the future. The unit weights and the void contents have been determined for 57 different gradings of one gravel. The results of the tests were reviewed in the October 27, 1928, issue of Rock Products and some of the more important conclusions which could be drawn from the data were given briefly in the October issue of the *National Sand and Gravel Bulletin.* While it is expected that the tests already completed bring out the fundamental principles involved, the investigation will be repeated using other gravels and other types of aggregate.

The second investigation to be undertaken is along the same lines, except that sand and other fine aggregate are the subjects being studied. The tests have been completed on one sand and are being repeated on another. The information from the tests of fine aggregates will supplement that obtained from the first investigation.

The third investigation to be outlined attacks a problem which is of vital interest to every gravel producer. It involves a study of the effect of finer sizes, such as pea gravel, in the coarse aggregate. The results should be of great value in determining whether or not various specification limits on the amount of finer sizes are more rigid than necessary. Compression and transverse tests of concrete for a wide range of conditions are being carried out. About half of the specimens have been made and the first ones are now being tested. A report of the results will be made available as soon as the investigation is completed.

Work is being done in a study of washed gravel ballast in cooperation with the ballast committee of the American Railway Engineering Association. Efforts are being directed principally toward the development of methods of determining the hardness and durability of gravel for ballast. A number of samples have been collected and the results of the tests will be compared with records of service.

General studies are being conducted, as conditions permit, of sands exhibiting unusual characteristics when used in concrete or mortar. Tests are now being carried out on a sand exhibiting features not encountered before in a long experience of testing sands.

The question of what amounts of soft, friable, flat and elongated pieces are harmful in gravel used for concrete is continually before specification writers. Studies on this question are now under way. The tests being carried out at this time deal particularly with the effect of flat particles. About 2 tons of gravel, separated into rounded and flat pieces, have been secured through the cooperation of a member company for this investigation.

A preliminary investigation of a method for determining the resistance of concrete to abrasion is under way. No standard method of making abrasion tests of concrete has been developed, and the methods proposed and used from time to time have generally required special apparatus not available in the average laboratory. With the establishment of the research laboratory of the National Association it was felt that equipment for such tests should be made available, but limited space and funds made it desirable to utilize standard equipment if possible.

The idea of using the standard Deval abrasion testing machine, common in most laboratories where stone and gravel is tested, was conceived. A few preliminary tests have been made with a view to establishing a tentative method of procedure. These consist of placing a

cylinder of concrete 6 in. in diameter in the Deval abrasion cylinder, the lid of which is raised slightly to permit the escape of detritus. Steel shot of "BB" size are used to create an abrasive action as the cylinder revolves.

Results thus far, using 6 by 12 in. cylinders of 1:2:4½ gravel concrete, show that an abrasive charge of about 3 lb. of shot produces the maximum abrasion. Further tests in which the length of cylinder was varied showed a greater percentage loss for a 6 by 6 in. cylinder than for the longer specimens. The loss in weight at 2, 5 and 10,000 revolutions indicated continuous abrasive action throughout the run.

Additional studies are being made of the proportions of the concrete mix, diameter of specimens, size of steel balls, and shape of concrete specimens best suited for the test, and, what is of greatest importance, the range of values obtained from various aggregates.

The preceding paragraphs have mentioned only problems on which work has been started in the laboratory. These represent only a very small proportion of the subjects on which information is needed. They are quite wide in scope, however, and will require a considerable period of time before comprehensive information is obtained. These investigations and the future ones must be supplemented by observations of field conditions if the greatest value to the commercial sand and gravel industry is to be fully realized.

The work of the laboratory and the engineering and research division, as a whole, will be directed first to the solution of problems on which information is most needed to make specifications clear and understandable.

Work of the U. S. Bureau of Public Roads in Rock Products Field in 1928

By F. H. Jackson

Senior Engineer of Tests, U. S. Bureau of Public Roads, Washington, D. C.

AMONG the more important concrete researches now in progress are: The studies of concrete curing methods; tests to determine the effect of variations in type and gradation of coarse aggregates on the strength of concrete; the effect of type of aggregate on the resistance of concrete to frost action; and investigations of methods for protecting concrete from the effects of sulphate waters.

Concrete Road Curing Tests

The method of curing concrete pavements by covering them with wet earth, which has been in quite general use for a number of years, has several disadvantages from the practical standpoint. This has resulted in numerous attempts to secure the same results by more simple and less troublesome means, and new methods have been devised which, before they can be accepted as adequate, must be carefully investigated. For the purpose of such an investigation 40 concrete slabs, each 2 ft. wide, 6 in. deep and 200 ft. long, were constructed at Arlington and cured by a number of different methods. The variables included in the study and the observations which are being made are such as should give, in addition to the primary object sought, valuable information relative to the effects of steel reinforcement of various types and weights; expansion joints; moisture and temperature changes, and subgrade resistance. These test slabs are to be kept under observation over a considerable period of time. In general, the development of checking and shrinkage cracks in the concrete will be considered as a relative measure of the performance of the various sections.

Investigations of concrete curing on actual pavement construction are in progress in Maryland in co-operation with the State Roads Commission and in Virginia on the Demonstration Road, which will be mentioned later.

Our knowledge of the strength of concrete and the variables which may affect it is based largely on tests of compressive strength and comparatively little is known of the effect of these same variables on the strength in bending and in direct tension. In a co-operative investigation now completed, with the New Jersey State Highway Commission, a study was made of the transverse and compressive strengths of concrete made with trap rock and gravel aggregates of several different gradings and also of the effect of these same variables on the yield of concrete. The results were such as to indicate the need for a more comprehensive study which might lead to conclusions more generally applicable to the common types of concrete aggregates. Such an investigation is now in progress and involves determinations of the yield of concrete and of the tensile, transverse and compressive strength of concrete made in four different proportions from four different gradings of eighteen different aggregates.

Investigate Weathering

It is known that in some instances the deterioration of concrete exposed to weathering action is due to the use of coarse aggregate lacking in durability or "soundness." Accelerated tests, designed to predetermine the soundness of aggregates, have been devised, but the relation between the durability indicated by the tests and the actual durability of the materials when used in construction has not been accurately determined. It is known that unsound materials will fail in the accelerated tests, but, on the other hand, it is also known that certain aggregates which fail in the tests will show a satisfactory durability when used in concrete construction. Frost action is considered as one of the more destructive of the weathering agencies, and an extensive series of tests is now in progress to determine the resistance to frost action of concrete in which aggregates of questionable durability are used.

The investigation involves eighteen different coarse aggregates which have been used in three different proportions in the fabrication of concrete test beams. The beams are being subjected to alternate freezing and thawing in a cold storage room, and at stated intervals the strength and appearance of these specimens are compared with those of duplicate control beams which have not been frozen. The aggregates themselves are also subjected to freezing and thawing and to the accelerated soundness tests. With the data which will result it is hoped to establish some relationship between the accelerated soundness tests of concrete aggregates and the resistance to repeated frost action of concrete in which these aggregates are incorporated.

Concrete Protection

Under certain conditions concrete is seriously affected by exposure to the action of sea-water or the so-called alkali waters of the West, both of which contain high percentages of sulphates. Complete disintegration of the concrete may result from such exposure. One of the important concrete investigations in the laboratories of the Bureau has resulted in the development of a method for protecting concrete from the action of sulphate waters by surface treatments of water-gas tar and coal tar. The treatment is particularly applicable to concrete bridges and, although still in the experimental stage, has already been applied to several bridges exposed to sea-water on the Atlantic and Pacific coasts and to others exposed to alkali attack in the western states. A phase of the investigation which is now in progress is the exposure of test specimens in the sulphate waters of Medicine Lake, South Dakota.

Garnets

THE TONNAGE and value of garnets for the years 1923 to 1927 show that the industry has been steadily declining, although prices have been stationary.

Year	Short tons	Value	Value per ton
1923	9,006	$688,437	$76.40
1924	8,290	674,176	81.50
1925	8,429	712,853	84.50
1926	6,397	523,875	82.00
1927	6,939	573,525	82.70

Research Work in the National Crushed Stone Association Laboratory

By A. T. Goldbeck
Director, Engineering Bureau, National Crushed Stone Association

AUTHORIZED less than a year ago the new laboratory of the National Crushed Stone Association is now in full stride. It was equipped shortly after its location was established in July at the Mercantile Building, 14th and S Streets, Washington, D. C.*

As in many other industries, the producers in crushed-stone industry, have come to a realization that they may look for greater progress through an increase in their usefulness, whether that be accomplished through betterment of their product, through the establishment of new or more effective uses or a more efficent serving of the users' needs. They have recognized that their industry must be based on the "solid angularity of fact", and that unfortunately much basic information regarding aggregates is practically non-existent, or is extremely indefinite. Thus they have begun laboratory research in their national organization to gain basic information to guide them and the users of their material.

Some of the Research Problems

Naturally an industry which is scattered throughout the entire United States and whose product varies considerably in character and usefulness is bound to have a large number of questions awaiting definite answers. Some of these questions are of local interest and concern only a few producers or some one particular product, others are of wide general interest to all producers. Problems of this latter nature demand first consideration for their solution will be of the utmost value. Some of these may be stated in a broad way as follows:

I. *What is the influence of the coarse aggregate on concrete and particularly concrete for highways* Investigations to answer this question should give answers to the specific questions:

(*a*) How does the coarse aggregate affect the compressive, transverse and tensile strength, the wear resistance and durability of concrete?

(*b*) How should concrete be proportioned to give approximately the same transverse strength when different coarse aggregates are used?

II. *What is the influence of gradation on:*

(*a*) Compressive strength.
(*b*) Transverse strength.
(*c*) Tensile strength.
(*d*) Workability.
(e) Yield.
(*f*) Expansion and contraction.
(*g*) Absorption.
(*h*) Density.

This investigation should show how to obtain the most economical concrete containing crushed-stone, coarse aggregate, and moreover is highly important in view of the growing tendency to require the shipment of stone in two or more sizes, later to be combined at a central proportioning plant for each concrete batch. The recent memorandum of the U. S. Bureau of Public Roads encouraging the shipment of separate sizes of stone makes this investigation highly important at the present time.

III. *To what extent are deleterious substances in coarse aggregate harmful to the concrete?*

Trouble has been had at various times in different parts of the country because stone has been rejected due to the presence of some of the above materials. Specifications have been arbitrarily drawn, limiting the percentage of deleterious substances to given amounts, and the question arises as to whether these arbitrarily chosen percentages are reasonable. The question of dust is important because in some states a limiting percentage of dust is specified and the whole matter of dust involves the possible necessity for using washing plants.

This entire study will involve the following questions:

1. What is the effect of flat and elongated pieces on the compressive, tensile and transverse strengths?

2. What is the effect of stone dust, in various percentages, on the several strengths and on the surface strength of the concrete as determined by a wear test, and on its resistance to freezing and thawing?

3. What is the effect of various percentages of shale on the strength of concrete and on its resistance to freezing and thawing?

4. What forms of chert are deleterious to concrete?

IV. *What characteristics should stone sand have for use as a fine aggregate in concrete?*

The reason for this investigation is to develop the greatest usefulness of stone sand, and to establish the limitations of this product for use as a fine aggregate in concrete. Natural sand in some localities is too fine or otherwise defective or is not procurable except by shipment over long distances. Here stone sand may be badly needed and may be economical to use.

Bituminous Mixtures

V. *The stability and other properties of bituminous concrete including brittleness are worthy of more study than has hitherto been given them.* Such studies will develop the best combinations for particular kinds of mixtures such as coarse and fine graded bituminous concrete and special cold and hot mixtures which are largely used under commercial names and which involve the use of large quantities of stone. Studies of special mixes are also worthy and offer promise of even revolutionary development.

Progress of the Laboratory Work to Date

In the few months during which active laboratory work has been under way several investigations have been in progress, all of them part of the general problems previously listed. These include:

(1) Effect of gradation on voids.
(2) Effect on concrete of deleterious substances in coarse aggregate:
(*a*) Dust coatings.
(*b*) Asphalt coatings.
(*c*) Partial clay coatings (about to be investigated).
(3) Test for the cementing value of screenings.
(4) Soundness tests on stone.
(5) Wear tests on concrete.
(6) Effect of coarse aggregates on strength and other properties of concrete.
(7) Routine tests on samples submitted by producers.

Future Work—For the immediate future the work will include:

(1) Soundness tests on stone.
(2) Wear tests on concrete.
(3) Effect of coarse aggregate on the strength of concrete.
(4) Effect of deleterious substances.
(5) Routine testing.

Results Reported—One report has just been published (November, 1928, issue of *The Crushed Stone Journal*) on the "Effect of Gradation of Crushed Stone on Percentage of Voids." Also a preliminary report has been written on "The Effect of Stone Dust on the Strength of Concrete." Still another report will be forthcoming on this subject in the near future.

In equipping the laboratory much apparatus had to be designed to meet our special needs and it is proposed to describe this special testing apparatus as time permits. Included in this category will be "A New Cabinet for Cement Briquet Curing and Storage", A New Wear Test on Concrete" and "A New Transverse Block for Beam Testing."

Three months is a very short time in which to show accomplishment in laboratory research, but it is hoped that the coming year will result in the establishment of some useful facts along several of the above lines of investigation.

*A description of the laboratory was published on ROCK PRODUCTS, December 8, 1926. —Editor

Work of the France Stone Company's Research Laboratory in 1928

By Dr. Herbert F. Kriege,
In Charge of Tests, France Stone Co., Toledo, Ohio

THE PROBLEMS confronting an industrial research laboratory may be classified conveniently into three groups—those whose solution provides the answer to immediate and usually pressing needs, those which lie in the field of that particular industry and aid in the manufacture, improvement, or sale of the articles produced, and lastly those problems of a more general nature which while applying more or less remotely to the parent industry have their chief value in that they contribute to our general fund of knowledge. In the past year the work of the France Stone Co. Laboratories has had its representation in each of the three classes just described. The results of some of these investigations will be discussed here but briefly as fuller accounts have either been published, or are soon to appear.

Causes of Unsoundness of Aggregates

The factors contributing to the unsoundness of aggregates have been studied chiefly as regards the resistance to sodium sulphate treatment, but also in actual freezing and thawing tests. Concrete specimens made of some of the doubtful aggregates were observed during the same tests. For some time it has been thought that porosity was an indication of weakness against freezing action. While this may be true for all types, including igneous, metamorphic, and sedimentary materials, it does not apply to the limestones and dolomites from some fifty sources within this Interior Geological Basin. Some dolomites having an absorption of over 6% resisted the attack of the sodium sulphate solution for more than forty immersions without sign of distress. Material successfully passing through 20 cycles is considered sound enough for the most severe usage, such as trickle filter bed media in sewage disposal works. Also, some of the densest minerals found in our sedimentary deposits, such as flints and cherts, have been found to suffer more in the soundness tests than their less dense associates. Soundness is a characteristic but poorly if at all connected with the usually determined chemical composition and physical properties. Thus, the regular laboratory procedure for the analysis of a new material has been enlarged to include this soundness test. Discontinuity of form or composition of matter is perhaps the best opportunity for points or planes of weakness in stone.

Some attention has been paid during the past year to the behavior of cherts and flints from both gravel pits and stone quarries. These highly siliceous minerals are more commonly associated with the great deposits of limestones, dolomites, and gravels in the Mississippi Basin than is generally supposed. Sufficient material from numerous sources was under observation to learn that not all cherts are unstable under weathering conditions or accelerated tests. It was found further that those cherts which did disintegrate did not go down completely, but usually split into several pieces, the smallest being from ¼ to ½ in.

Dissolution Rate of Limestone

The dissolution rate of limestone is of interest to several great industries, for upon its rate of dissolution will depend the efficiency of limestone as a soil acidity corrective, as stock feed additive, as chemical precipitants, etc. Since it has been found that the dissolution rate had no direct bearing upon any other physical or chemical property it has become necessary to include this procedure in the regular laboratory scheme of analysis. This fact has not been recognized generally so that it is not an unusual thing to hear a customer using this material ask for limestone of a certain color "since it dissolves faster." While the chemical composition has an effect on the dissolution rate so that dolomites as a class are slower in dissolving than are high calcium limestones, it appears that mineral association plays an equally important part in this characteristic.

Gradation of Aggregates

Since the subject of the sizing of stone aggregate for various purposes is such a perennial one, this matter was not omitted. Special thought was given to the gradation of stone in its effect upon the voids and weight of the crushed product and its bearing upon the yield and strength of concrete made from it. Also the importance of the gradation of the fine aggregate was investigated since it had been possible in previous experiments to vary the compressive strength of concrete at will by a relatively small change in the sand used, and entirely within specification limits. It seems logical that a sand of certain fineness and gradation would be a more adaptable fine aggregate for gravel with its rounded particles and smaller voids than for stone, while another sand is just the reverse. The results of a little research along this line showed this idea to be true to a remarkable degree

Washed Limestone Sand as Fine Aggregate

One phase of the research which took an immediate turn to the practical side was in connection with the development of a washed limestone sand as a comparatively new concrete fine aggregate. Although rather unpromising results have been obtained for some time with limestone "screenings" as fine aggregate it was found that by a washing and classifying process an entirely different and satisfactory product could be made. Mortar tests indicated that the fraction passing 100-mesh could be present in this washed sand in excess of the 5% limit usually specified, and with beneficial results. In fact, the best mortar strengths were obtained with this sand containing 13.5% below 100-mesh, the other fractions being left in their usual proportions.

This fine material is not silt, but is practically pure limestone dust as frequent chemical analyses showed. Because of these facts the specification limit on the below 100-mesh fraction was raised to 7.5%. The manufacture of this washed limestone fine aggregate was soon begun and continued throughout the season. Over 12,000 tons of this sand were used in the construction of a concrete pavement west of Toledo. The results were entirely satisfactory as to the workability of the batch and the transverse and compressive strength of the finished mass. A concrete pavement of excellent riding properties and evident durability has been made of limestone washed sand as the only fine aggregate or mixed with natural bank sand when the demand overtook the supply of the former.

An average screen analysis over a month's production follows:

On 4-mesh	1%
Through 4-mesh—On 10-mesh	26%
Through 10-mesh—On 20-mesh	33%
Through 20-mesh—On 30-mesh	14%
Through 30-mesh—On 50-mesh	11%
Through 50-mesh—On 100-mesh	9%
Through 100-mesh—On pan	6%
	100%

Comparison of Coarse Aggregates

One of the more extensive investigations undertaken this year dealt with a comparison of a number of fine and coarse aggregates in transverse, compression, and yield tests. Three gravels, one slag, and eight brokenstone, coarse aggregates in combination with five fine aggregates were made into concrete, each test batch containing about 7 cu. ft. which was sufficient to make six beams 6 x 6 x 44 in. for three transverse breaks each, and six 6 x 12-in. cylinders for the compression test. The batches were mixed in a two-bag mixer, the proportioning being by weight according to the scheme recently developed by Messrs. Emmons and Kendall, of the Michigan state highway department. This plan calls for the use of more sand with those coarse aggregates of greater voidage.

The result is that concrete of almost constant cement content, practically uniform workability regardless of the type of coarse aggregate, and comparable strength is obtained. While the results of our tests are

not as yet all in hand, enough data have been collected and studied to point out certain trends. It is evident that the transverse or flexual test is more specifically a test of the coarse aggregate used than is the compressive test. In the former test the irregularity, elongation, and structural strength of the individual pieces of coarse aggregate have an effect since in breaking transversely the reinforcing action of the aggregate is brought into play. Here it was found as before that selecting a sand because of its gradation to be combined with a certain coarse aggregate gave marked advantage. Just because two aggregates meet their respective gradation specifications is no proof that their combination will be anything like an ideal mixed aggregate.

Some Advantages of Porous Coarse Aggregates

In these experiments as in previous research, it was noted that the stone of moderate or high porosity had lower strength values at 7 days but higher at 28 days and later ages than was to be expected from a comparison of denser stone in other batch of similar cement content, etc. This is true in compressive tests more than in transverse, since in the latter case the lower structural strengths would be felt. This behavior points to a probable effect of the porous coarse stone on the curing conditions of the mortar encasing it. It would seem that a removal of mixing water with the release of this moisture during later curing stages would bring about the thing observed. It does not take much of an imaginative flight to appreciate the effect of many little reservoirs of curing water within the concrete mass upon the development of later strength.

In order to explain certain irregularities in the results of concrete tests made above, a determination of the cement content of the *actual member tested* was made according to the chemical method developed by the author several years ago. It was found in nearly all cases of high or low strength values that a corresponding irregularity in the cement content occurred also. Furthermore, with all the care and precautions observed by two trained men, working with a standard mixer, weighed proportions, and according to A. S. T. M. procedures, differences in strength and also in the cement content of 10% to 15% between neighboring specimens from the same batch happened quite often. This leads one to believe that many differences no greater than these which have been the centers of discussion and roots of prejudice for many seasons could have been accounted for from the first if the true cement content of the specimens tested had been determined.

The above outline indicates in a measure the research activities of the France Stone Co. Laboratories during the past year. It is hoped that with the information so gained not only the parent organization but also the entire stone industry may be benefited.

Slate in 1928*

By Oliver Bowles

Supervising Engineer, Building Materials Section, U. S. Bureau of Mines

SLATE, which in the early years of its application to human needs was used only as a roofing material, is now applied to many diversified uses, the chief of which are for roofing, electrical switchboards, blackboards and school slates, structural and sanitary uses, grave vaults, floors and walks, and as building stone in walls and copings. Slate is also crushed into granular form for the manufacture of slate-surfaced roofing, and is pulverized for use as a filler in paint, asphalt, and other products. The industry faces keen competition in every branch of its activity. For this reason it has not shown the rapid growth expected of an industry developing a mineral product of such high merit. Slate, properly selected and prepared, gives excellent service in every field of its application.

The most noteworthy advance in the industry since the war was made during the years 1922 and 1923, when the annual slate production value increased from $7,322,000 in 1921, to over $12,000,000 in 1923. This growth was due in large measure to the greatly expanded public building programs which had lagged during the war period. It is significant also that this remarkable growth of the industry was coincident with the establishment of a National Slate Association, organized for the purpose of establishing better business principles and more advanced progress in the industry, and of promoting wider publicity of the adaptability of slate for its diverse uses. From 1923 to 1927 this growth was maintained, with the production value fluctuating above or below the $12,000,000 mark. In 1927, however, the sales decreased nearly $1,000,000, following the general downward trend of the construction and electrical industries.

No statistical information for 1928 can be supplied at this time, as preliminary estimates compiled by the Bureau of Mines will not be available before January 15, 1929. Therefore only general statements can be made regarding trends and tendencies.

Slate Districts

Aside from granules, which are manufactured in several states quite independently of massive slate production, slate in the United States is confined to five producing districts, as follows: (1) Northampton and Lehigh Counties, Pennsylvania; (2) the Vermont-New York boundary district; (3) the Monson, Maine, district; (4) the Peachbottom district on the Maryland-Pennsylvania border, and (5) the Buckingham County district of Virginia. In the Pennsylvania district activity has fluctuated considerably, and on the whole production will probably equal, and may even exceed, that of 1927. In the Vermont-New York district it seems unlikely that production will show any advance over that of 1927. The products of this district are roofing, electrical, and structural slate, granules, and slate flour.

The production of the Monson, Maine, district consists mainly of electrical switchboard slate, with a limited output of roofing, blackboard and structural slate. Little change in activity is to be noted in this region in 1928. The Peachbottom district produces crushed and ground slate chiefly, but has a small output of roofing slate; the latter product probably showed some reduction in 1928. Efforts are being made to revive the roofing slate industry by reorganization.

The Virginia quarries were normally active. The chief product is roofing slate, and a subsidiary crushed and ground product is also prepared.

A summary of general conditions in the industry, based on reports of the National Slate Association and estimates of the slate committees of the three Eastern Shipping Advisory Boards (New England, Atlantic, and Southeastern), indicates that the production in 1928 will rank with that of the best years since the war in all but blackboard slate, and shipments of this slate may exceed those of 1927.

Causes of Lack of Growth

The present lack of growth in the industry may be attributed to various causes. One cause which affects Pennsylvania particularly is the recession of school construction to normal activity; about ten years of active building was required to complete building programs retarded by the war. The moderate depression in the blackboard industry is

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SLATE SOLD IN UNITED STATES, 1923-1927

	Roofing slate			Mill stock			Otherwise mostly granules	
Year	No. of squares (100 sq. ft.)	Value	Per square	Sq. ft.	Value	sq. ft.	(value)	Total value
1923	507,587	$4,582,535	$ 9.05	11,109,480	$4,159,644	0.37	$3,334,445	$12,076,624
1924	469,393	4,626,614	9.85	10,009,180	3,922,366	0.39	3,227,036	11,776,016
1925	494,530	5,084,945	10.30	11,077,860	4,231,477	0.38	3,258,904	12,575,326
1926	465,900	5,079,087	10.92	10,278,130	4,191,185	0.41	3,082,495	12,352,767
1927	468,560	4,949,940	10.57	9,287,680	3,519,386	0.38	2,911,410	11,380,736

not to be regarded as permanent, for there is a growing demand for blackboards. In modern house construction, for example, there is a tendency to build in slate blackboards in nurseries, and blackboards are also finding wider use in hotels and commercial houses. Another cause contributing to the lack of growth, and one which constitutes a persistent and more serious problem to the industry is the increasing competition of substitute roofing materials, such as asbestos and asphalt shingles, which are advertised much more widely than slate. Electrical slate meets with similar competition from the various composition products.

Better Quarry Practice

While the industry appears to be marking time at present, there are certain encouraging factors which point to the probability that $12,000,000 is by no means the saturation point in slate consumption. In the first place, the industry is making long strides toward a better technique in quarrying and manufacture. A notable example is the substitution in Pennsylvania of wire saws in place of channeling machines for making the primary cuts in the quarries. This equipment, introduced by the Bureau of Mines in cooperation with the National Slate Association and some of the operators about two years ago, has proved of great advantage in conserving slate, saving time, and reducing production costs. It is now in successful use in about 30 quarries.

Several companies are now operating mills for the manufacture of roofing slate, and at least two new mills have been placed in operation during 1928. Most of the mills are giving satisfactory service, though some of them are not regarded as successful.

A. S. T. M. Helps

Another step that will undoubtedly benefit the industry is an extensive program chiefly under the auspices of Committee D-16 of the American Society for Testing Materials to establish efficient testing methods and to develop specifications which will tend to divert the various qualities of slate to the uses for which they are best adapted, thus insuring the most enduring and satisfactory service. Tests in progress or proposed at the present time have to do with strength, hardness, conductivity, color life, and resistance to weathering or chemical action. In connection with the coming annual slate conference in New York in January, 1929, it is planned to hold the meeting of Committee D-16 as an open session, at which the technical work on slate now in progress or proposed will be freely discussed.

Professor Charles H. Behre, Jr., representing the Pennsylvania State Geological Survey, has made a very thorough study of the geology of Pennsylvania slate, and has made recommendations for prospecting and development which, if followed, would result in definite economies to the producers.

Another advance toward better economic conditions is an extension in some localities of joint marketing agencies, establishing better contacts between producers, distributors, and roofing and setting contractors, thus promoting sales and insuring better service to the ultimate consumers. Three such agencies have recently been established, viz., the Unfading Roofing Slate Co., of Fair Haven, Vermont; the Weathering Green Slate Co., at Granville, N. Y.; and the Pennsylvania Blue-Gray Roofing Slate Association, of Pen Argyl, Penn.

Asphalt and Bituminous Rock

THE TERM "bituminous rock" is used to designate all rocks that contain appreciable quantities of asphalt. This class of rock includes asphaltic earth, sand, "rubber stone," shale, sandstone and limestone, of which the last two products are the most important. Gilsonite, grahamite, ozocerite and wurtzilite are asphaltic minerals.

Bituminous rocks are used chiefly in paving and highway work, and for this purpose a 6% asphaltic material is necessary. During 1928 there was considerable activity in developing deposits of this material, and it is claimed that considerable savings could be effected by their use. Canadian users of asphaltic sands at Fort McMurray, in northern Alberta, expect to reduce costs of surfacing from $1.23 to 78c by using this class of material as compared to imported asphalts. The Standard Rock Asphalt Co., of New York, acquired the holdings of the Natural Rock Asphalt Co., Owensboro, Ky. The Kyrock Asphalt Co., Kyrock, Ky., has added considerable equipment to its new quarry at Sweeden, Ky. A new rock asphalt project is reported to be under way at Leitchfield, Ky., involving the erection of a crushing and refining plant to cost $2,000,000. As evidence of activity in this field, nine incorporations were recorded with capitalization of $3,635,000. One of the most notable of these was the Utah Rock Asphalt Corp.'s plant near Sunnyside, Utah, which was started early in the year and is now ready to operate, according to reports. Other companies reported as building of enlarging plants were the Standard Rock Asphalt Co., of San Antonio, Tex.; Contractors Rock Asphalt Co., Birmingham, Ala.; Marble Cliff Quarries, Columbus, Ohio, and the Uvalde Rock Asphalt Co. at Cline, Tex. T. L. Thogmartin and Sons, Fort Scott, Kan., are stripping a deposit near Deerfield, Mo., preparatory to production. A seven-mile railroad was constructed near Bellamy, Mo., to handle crushed rock asphalt.

Production was as follows:

Year	Short tons	Value	Value per ton
1923	400,236	$2,885,631	$7.22
1924	562,367	3,958,339	7.04
1925	584,850	4,148,400	7.10
1926	715,180	4,484,960	6.28
1927	839,040	5.605,850	6.68

Asbestos

THE following table taken from "Mineral Resources of the United States" shows the value and tonnage of imported and domestic asbestos, and also shows the gradual increase of the States' production as compared to imports:

The Southern Asbestos Co., Charlotte, N. C., recently formed in Delaware, took over the North Carolina company by the same name and is reported as acquiring more asbestos properties in that state. The National Asbestos Co., Plumtree, N. C., recently completed a new plant and is reported as producing 30 tons of asbestos daily. The Asbestos Corp., Montreal, Canada, recently awarded a contract for 1,000,000 yd. of stripping to Roger Miller and Sons, of Toronto.

An interesting situation developed when the United States Government filed suit in the United States District Court against three American importers and manufacturers, and three Canadian producers. The government charges that these companies have brought about a monopoly of the asbestos business in the United States. The complications that are apt to arise from this situation were discussed in March 3 and April 14 Rock Products.

There was considerable activity in the African asbestos mining districts; the largest producers, Rhodesian Asbestos Corp., Ltd., is reported to have what is probably the richest deposits of asbestos in the world. This company produced 26,000 tons in 1927. Other producers are the African Asbestos Mining Co., Ltd., and the Union and Rhodesian Trust, Ltd. These companies are all reported as considering plans for expansion.

A California company was the only incorporation reported, and was for $100,000.

DOMESTIC PRODUCTION OF ASBESTOS, 1923-1927

	—Domestic Production—			—Imports—		
Year	Short tons	Value	Value per ton	Short tons	Value	Value per ton
1923	227	$ 9,626	$ 42.40	212,420	$7,445,143	$35.05
1924	300	42,526	141.75	183,250	5,602,945	30.60
1925	1,258	51,700	41.15	230,520	7,134,302	31.00
1926	1,358	134,731	99.20	257,621	8,142,505	31.60
1927	2,981	336,882	113.00	223,693	8,150,340	36.60

What the American Concrete Institute Is Doing for Cement and Aggregate Producers

By Harvey Whipple
Secretary, American Concrete Institute, Detroit, Mich.

A SERIOUS ATTEMPT to review recent work of the American Concrete Institute in terms of interest to the readers of ROCK PRODUCTS *must*, without splitting hairs too fine, result in a review of the entire recent work of the A. C. I. There is nothing pertinent to the subject of better concrete—better concrete through a better understanding of its characteristics—that is not or should not be of interest to ROCK PRODUCTS readers.

A more economical solution of any problem of design, construction or manufacture—and all such problems at some point of their solution are economic problems—inevitably touches the producers of rock products.

One of the difficulties in all scientific progress, through such a community interest as is provided in the American Concrete Institute, is in finding the common ground among various groups of interest, so that all the factors that have any relation to any given problem may be brought together.

Producers of concrete building units sometimes think that everything not grouped on a convention program under the obvious head of "concrete products" is alien to them. Producers of aggregates sometimes feel that any paper or report whose title does not specifically mention "aggregates," or "gravel," or "stone," or "slag," is none of their affair.

The fellow whose work is somehow to get the structure up a floor a week or better, is occasionally deaf to a message of the profoundest interest to him because it happens to come in a session at which professors and laboratory people state the conclusions of research.

The alert in all these groups find pertinent things in what to others are most unexpected places. They digest these pertinent things, apply them to their own job and capitalize their new knowledge several strides ahead of others who wait to have shown to them in picture and diagram the ideas which a few have already turned into profit.

The rewards will always go to those who, given a new fundamental fact, can see its relation to their own jobs. That is why, in attempting to review A. C. I. work for a so-called group interest, your reviewer sees group interest only as a fractional thing which can't possibly get along by itself. A bloc or group interest is almost always like looking through a microscope—the higher the magnification of detail, the smaller the field of view.

The February Convention of the Institute

L. E. Williams, an engineer representing interests which produce a considerable part of the concrete aggregate of the Detroit district, will present a paper at the 25th annual A. C. I. convention in Detroit, February 12-14, next, under the title "Confusion of Specifications for Aggregates." This paper states the troubles of aggregate producers, states them very ably, based on years of experience in meeting half a hundred varied specifications; a variety which serves no good purpose.

This variety of specifications is due to a road man thinking of *his* requirements, an engineer's specification writer of *his* requirements for a building job, a block manufacturer of *his* real or fancied needs, a sidewalk contractor or a city specification writer of *his* own work, a stucco man setting down *his* demands in still other terms, and so on and on. All this goes on being complicated and recomplicated and the public pays the bill for the needless motions the aggregate producers have to go through.

Concrete Aggregate Specifications

Aggregate requirements are fundamental to all concrete work. The gradual absorption by the working forces, of our more recent knowledge of concrete control, focusses attention on our need for some solution of the problem of aggregates and quality. An Institute committee (E-5, Aggregates, R. W. Crum, chairman; F. H. Jackson, secretary) has been working several years to produce at least an outline of a purchase specification for aggregates. This year the committee produces a revised form of specification. These two contributions to the next A. C. I. convention program are so labeled as to be the concern of all producers of aggregates, but behind these are years of papers on quality control in field and factory, of building regulations and concrete specifications generally, all with a fundamental bearing on aggregates, all in some measure contributing to the situation in which Mr. Williams and Committee E-5 are trying to bring some order out of chaos. These are two items illustrative of the thought that permeates A. C. I. work. No fundamental problem of concrete; no characteristic of concrete manifesting itself in whatever work the concrete is placed, is a matter alien to any group interest.

And without any thought here in this brief space to review the 882 pages, Volume 24 of the A. C. I. *Proceedings*, published last June, it is proper to mention that the group of papers on "Workability" is of the broadest interest, because the results in so many widely different kinds of work are affected by it, and because workability is the product of many factors, not the least of them "aggregates" as covered in A. T. Goldbeck's contribution to this symposium.

Even "Design" Subjects Should Interest Producers

Papers from architects' offices, by Sidney F. Ross, on "Decorative Painting on Concrete," and by Emil Praeger, on "Reinforced Concrete as Applied to Monumental Buildings," are not merely architectural. In widening the concrete horizon, in viewing concrete as a more nearly complete architectural medium, it widens the avenues of achievement for everyone designing or making concrete or anyone contributing the necessary accessory materials.

Getting into the so-called research and design groups, every paper which adds its bit to our knowledge of ease and precision of design and to the perfection of our technique, or the fundamental properties of the material of which so much is required; every such paper is a working force in the employ of every group interest of the field.

Cement Products Field

So obvious to ROCK PRODUCTS readers as scarcely to need mention is that other group of papers and discussions upon which is founded the beginning of an effort to bring a recognition of standards of quality in the field of manufactured stone.

The foregoing is a sketchy reference to a very few items in the record of the Institute's year ending June 30, last.

But as nothing is ever really finished, we look forward to the 25th annual convention in Detroit, February 12-14, to stop a few more gaps in the structure of our knowledge of concrete.

The convention begins with "A Condition Survey of Concrete Structures," a group of papers based on examinations of structures already long in service under varying conditions of use and exposure. Wherein have they failed—if they have failed? Why? What materials and technique went into work that has proved its worthiness?

New Developments in Concrete Construction

And because it is salutary to examine critically the record of past performance, so too is it good to seek inspiration in new achievement. Mr. Freyssinet, famed fabricator of spidery concrete arches 600 ft. long, will tell in an illustrated paper coming from France something of the design and construction of

the Plougastel bridge near Brest. L. G. Lenhardt will tell the care in selection of both cement and aggregate and of the niceties of control to put 4000-lb. concrete into Detroit's water-supply tunnels. A. S. Douglass and J. S. Nelles will record Detroit Edison Co.'s convincing experience with rigid control as a means to economy. John M. Bischoff will tell how the city of Detroit has checked up on the performance of contractors on every important job, and by publishing strength records kept them alive to the necessity of vigilance in concreting practice.

There will be an important group of papers on design and research; the manufacturers of cast stone will discuss pressing problems in a session all their own, as will also the producers of standard building units —block, brick and tile. The U. S. Bureau of Standards has been making a careful survey of commercial cast stone, and J. Tucker, Jr., and C. W. Walker will report the results. Fred Weigel, of Knoxville, Tenn., and others will call into question the value of present absorption tests.

Centrally-mixed concrete will be up for critical consideration by P. J. Freeman, of Pittsburgh, and others.

These are but a few of the high points, the two final sessions being devoted to a collection of papers inquiring into the special characteristics of concrete demanded by special conditions of exposure and use—sea water, alkali soil, in roads, floors, houses, in stucco, building units and for fire resistance.

And after three days of it the meeting will end with the 25th annual dinner. As the National Concrete Products Association, the Association of Cast Stone Manufacturers, the American Concrete Pipe Association and the prepared stucco manufacturers all plan meetings in Detroit the same week, the 1929 meeting promises an occasion of large importance to all Rock Products readers.

The Committee on Nonmetallic Minerals

Of the American Institute of Mining and Metallurgical Engineers—Activities of 1928

By Oliver Bowles, Chairman, Nonmetallic Committee, A. I. M. E.
U. S. Bureau of Mines, Washington, D. C.

THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS has a membership of about 10,000, and is therefore the largest technical society in America representing the mining industry. Of the various groups that make up this great and diversified body, the committee on nonmetallic minerals provides most interest to the readers of Rock Products, for it deals with such subjects as stone, sand and gravel, slate, asbestos, barytes, magnesite and similar mineral commodities that are not connected defintely with metal production. The chief function of the committee is to secure papers of high merit for presentation at meetings and subsequent publication. The most important meeting is the annual convention held in New York City every February.

At the February, 1928, meeting two full sessions of nonmetallic papers were held, and in addition several papers were provided for other sessions. The papers related to varied subjects including stone, sand, diaspore, magnesite and slate. The nonmetallic committee and guests also met together at the Engineers' Club for a noon-hour luncheon, and a round-table discussion of the aims and purposes of the committee, and plans for work during 1928. As a result of this free exchange of ideas, one tangible step was taken toward intensifying the work of the committee. This consisted in the appointment of several subcommittees each with a subchairman. It was felt that the interest of each group could be promoted to better advantage in this way, and also that it would tend to decentralize the work of the chairman and secretary, placing a larger share than formerly of the responsibility on the subgroups. In addition to a general group, the membership of which consists of those having a greatly diversified interest in nonmetallic minerals, the following subcommittees were established: (1) Crushed stone, sand and gravel; (2) Cement; (3) Lime and gypsum; (4) Refractories.

This arrangement has to quite an extent attained the desired end, for toward the latter part of 1928 the committee had a greater number of prospective papers for the coming meeting than it ever had in previous years. Activity has been shown also in other ways. At the joint meeting of the American Institute of Mining and Metallurgical Engineers and the American Mining Congress held at Los Angeles in September, 1928, one entire session was devoted to nonmetallic papers, largely through the efforts of Robert Linton of Los Angeles, a member of our committee.

The following papers were presented: "Nonmetallic Mineral Industries of the West," by George J. Young; "California's Commercial Nonmetallic Minerals," by Walter W. Bradley; "Some Properties of Certain Oil-Refining Adsorbents," by C. W. Davis and L. R. Messer; "Clay Prospecting and Mining in California," by W. F. Dietrich; "Tripoli—Its Occurrence and Use," by P. B. Butler; and "Natural Gas Conservation in California," by Martin Van Couvering.

Plans for 1929 Meeting

The February, 1929, meeting is now our definite objective, and the prospective program promises to be interesting, though no very definite statements can yet be made regarding the papers to be presented. About twenty prospective papers have been brought to the attention of the committee, and it is probable that at least six or eight will materialize in time for the meeting.

The following are being counted upon with a fair degree of assurance, some of the manuscripts having already been submitted for criticism and approval: "The Stability of Chert," by Dr. H. F. Kriege of the France Stone Co., Toledo, Ohio; "Mining and Preparation of Clay," by H. E. Nold, Ohio State University, Columbus, Ohio; "History and Technical Developments in Refractories," by S. M. Phelps of the Mellon Institute, Pittsburgh, Penn.; "Dressing Fluorspar by Decrepitation," by W. D. Johnston of the U. S. Geological Survey, Washington, D. C.; "Soapstone Mining in Virginia," by C. W. Ryan, Lynchburg, Va.; "Dust Collecting from Gypsum Calcining Kettles," by H. J. Brown, West Newton, Mass.; "The Barytes Industry of Missouri," by W. M. Weigel, St. Louis, Mo.; "Indiana Limestone, Relation of Its Natural Features to Its Commercial Grading," by G. F. Loughlin, U. S. Geological Survey; "The Mineralogy of the Drill Cores Taken in Potash Drilling in Texas and New Mexico," by W. T. Schaller and E. P. Henderson, U. S. Geological Survey; "The Results of Potash Prospecting in Texas and New Mexico," by G. R. Mansfield, U. S. Geological Survey. The authors of some of these papers may not find time to complete them, or some other obstacle may stand in the way of their presentation, but with this array of probable material before us we are looking forward with a fair degree of confidence to a successful meeting.

The luncheon-hour session was so successful at the last convention that the committee is now considering arrangements for a similar session in February, 1929. This occasion permits a free exchange of ideas on the betterment of our work and thus promotes greater usefulness in this important branch of the institute's activities.

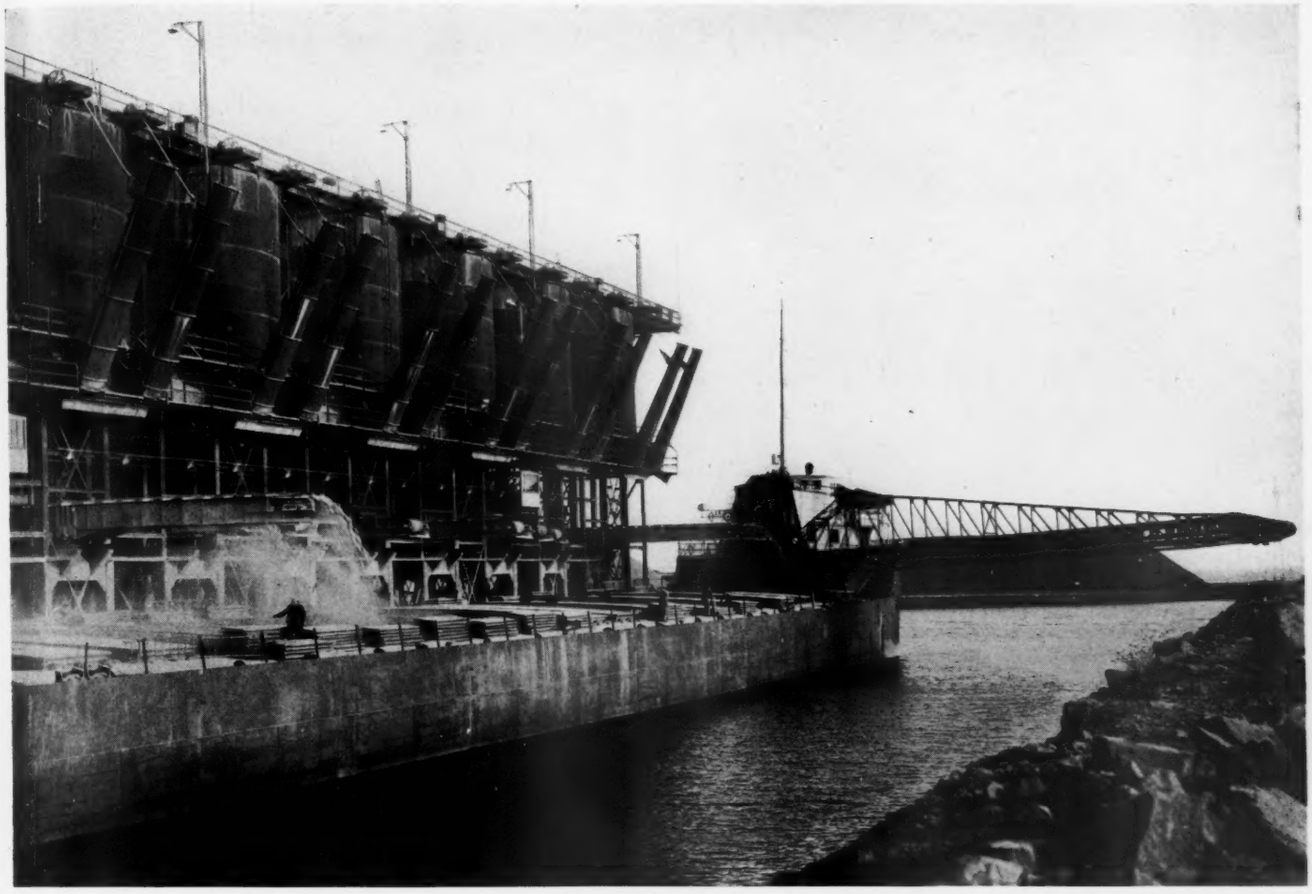


Fig. 1. The older bins in front of the new concrete bins at the Alpena, Mich., plant of the Michigan Alkali Co., with a boat receiving stone through two of the shuttle belt conveyors from the apron conveyors

How Michigan Alkali Company Handles Cargoes of Limestone

By C. E. Martin
Local Manager, Chain Belt Co., Detroit, Mich.

MOVING MATERIALS by the force of gravity is to be preferred for obvious reasons over the employment of mechanical power for the same purpose, in many instances; yet there are conditions which makes the reverse true. A striking example of this developed at the plant of the Michigan Alkali Co. in Alpena, Mich.

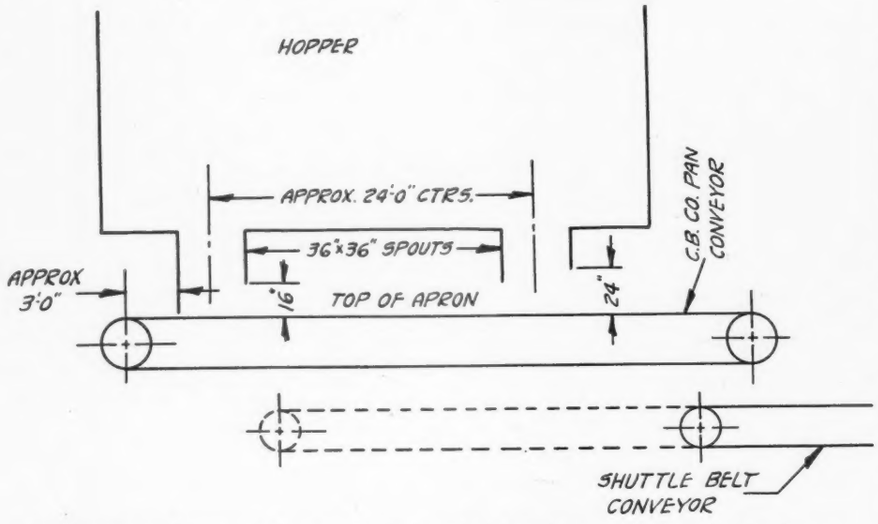
A large limestone quarry is operated by this company at Alpena, the stone from which is used mainly in two products—soda ash and portland cement. From the quarry the stone is taken to crushers and then screened. Stone under 4 in. is conveyed to the plant of the Huron Portland Cement Co. located near the quarry. Stone from 4 to 6 in. in diameter is carried in railroad cars to a trestle and dumped into storage bins located above a ship dock. From these bins the stone is loaded into Michigan Alkali Co. steamers and shipped to its plants in Wyandotte, Mich.

For a number of years the steamers were loaded by gravity through spouts from a row of bins located along the edge of the dock (Fig. 1). This method was very good from the standpoint of rapid loading, but there were several objectionable features.

Among the disadvantages of the gravity discharge system was that on account of the speed of discharge a considerable breakage of stone to sizes smaller than desirable occurred. Again on account of this speed there was some deflection away from hatchways of stone, which struck the steel decks of the steamers with considerable velocity and rebounded. This involved an element of danger and caused extra work in cleaning decks. Then, too, the point of entrance of stone into the hatchways, which extended entirely across the decks of the steamers, could only be varied by raising or lowering the spouts. This caused a change in discharge velocity, and while the stone was distributed quite evenly, the cargoes could not be trimmed in the holds as well as could be desired.

In 1924 the Michigan Alkali Co. decided to provide additional dock storage for stone and a row of concrete bins was built parallel to and in the rear of those then existing. The tops of the new bins were made level with the old ones, but the new bins were made considerably deeper, thus giving them greater capacity.

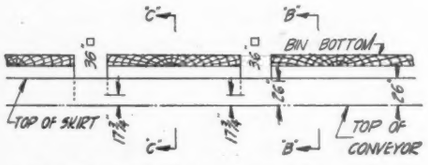
The matter of loading the bins was simple, as the same method employed on the older ones was used. That of unloading, however, was not so easily met. To keep the bottoms of the new bins as low as possible to provide maximum capacity and at the same time retain sufficient room for discharging conveyors was the chief problem.



Section through one of the new hoppers, showing the two spouts discharging to the pan conveyor which in turn discharges to a shuttle belt conveyor

Headroom was limited beneath the old bins under which the proposed discharging conveyors were to operate, and altogether the conditions were such as to require experienced engineering.

The problem was met by William P. Harris, general superintendent of the plant, and his organization; and it is the consensus of opinion of those who have seen the equipment that a more efficient arrangement would be difficult to conceive. The



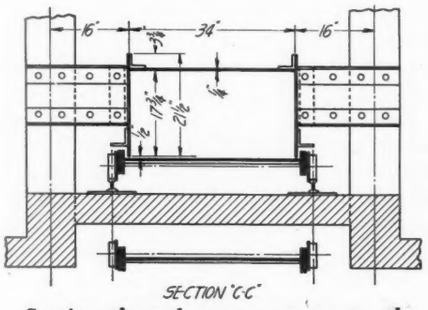
Detail of bin bottom, showing particularly the position of the two cross-sections shown on this page

carrying apparatus consists of a stationary steel apron, or feeder conveyor, located under each bin and a shuttle belt conveyor underneath each apron conveyor. The steel apron feeders, which were furnished by the Chain Belt Co., of Milwaukee, are 36 in. wide and about 36 ft., center to center, of head and foot shafts. Style "B" double-beaded flights make up the bed of the conveyor. These are $\frac{5}{16}$ in. thick and are attached to a double strand of No. 2343 "Rex Chabelco," all-steel, roller chain, 9-in. pitch. At every second joint of the chain a 1-in. steel axle, or through rod, connects the two strands. The inside link of the chain is 5 in. wide, forming a skirt or side plate for the carrying aprons. The conveyors travel at a speed of 73 ft. per min. beneath stationary steel side plates or guides 26 in. high, the bottoms of which come very close to the high points of the aprons and just inside the high side of the chain.

How the Conveyors Operate

Stone is fed vertically to each apron conveyor through two openings each 36 in. square spaced about 24 ft. apart. No gates or valves are used on either opening, the stone flowing freely from bin to conveyor. The spout on the opening farthest from the discharge end of the conveyor is brought down so that the conveyor may draw a load 17 in. deep from this opening. A heavy steel plate cover, located close to the top of the load, extends from the front of the first spout to the rear of the second. This prevents stone wedging behind the second spout. The opening of the second spout at the front allows the conveyor to draw an additional load of stone to a maximum depth of 24 in. Each apron conveyor has a capacity of 1000 tons per hour and is driven by a 40-hp. motor direct-connected to a speed reducer, which in turn is direct-connected to a $4\frac{15}{16}$-in. head shaft.

In working on the method of discharging from the bins to the feeder conveyor it was necessary to make the discharge openings large enough to prevent the stone arching, and thus blocking the openings. On the other hand it was desirable to keep the pressure, from the weight of stone above, within practicable limits on the feeder conveyors. Also it was apparent that the conveyors would encounter resistance at the spouts nearest the head ends. Openings 3 ft. square were decided necessary for clean discharge

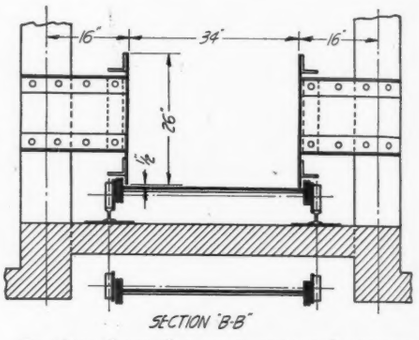


Section through pan conveyor to the right of both spouts, indicating the position of plates at this point

and required capacity. Then by the selection of sturdy conveyor equipment, applying sufficient power, making a few minor adjustments after the first unit was tested, the apron conveyors went into service. While the work is severe, yet in four seasons operation these conveyors have required little attention beyond lubrication of bearings.

After developing the apron conveyors to a point where there was no question about their functioning properly, the rest of the problem was worked out readily. With an even flow of stone from apron to shuttle-belt conveyors, the latter work smoothly, as all well designed belt conveyors always do.

When a steamer docks and its hatch covers are removed, operators on the dock throw their switches and the loading operation begins. The mobility of the shuttle-belt conveyors enables the operators to run their discharge ends to a point where the stone will flow into the hold on the side farthest from the dock, and then by drawing the shuttle back, the stone is evenly distributed entirely across the cargo space. The stone flows at a uniform speed from



Section through pan conveyor between the two spouts, showing the cover plate and side plates

the conveyors and at a much lower velocity than from the gravity discharge chutes. There is little deflection of material outside the hatch openings and much less breakage.

Loading 7000 Tons in Less Than Two Hours

The average cargo is 7,000 tons and the loading time averages from one and one-half to one and three-quarter hours. Occasionally this time is reduced considerably. A record was made when 7175 tons were loaded into the steamer *Conneaut* in 45 minutes, when the steamer was docked without ballast. It might be explained that generally steamers arrive in ballast and this is pumped out, while the stone is loaded. As the ballast cannot be discharged as fast as the stone can be loaded, the latter operation is interrupted at intervals. If it were not for this the record made with the *Conneaut* would be quite usual instead of exceptional.

In a season of eight months approximately 650,000 tons are shipped.

In the view, Fig. 1, shows a boat at the loading dock with three shuttle belts dis-

Fig. 2. The head end of one of feeders, giving a fine idea of load of stone each one handles

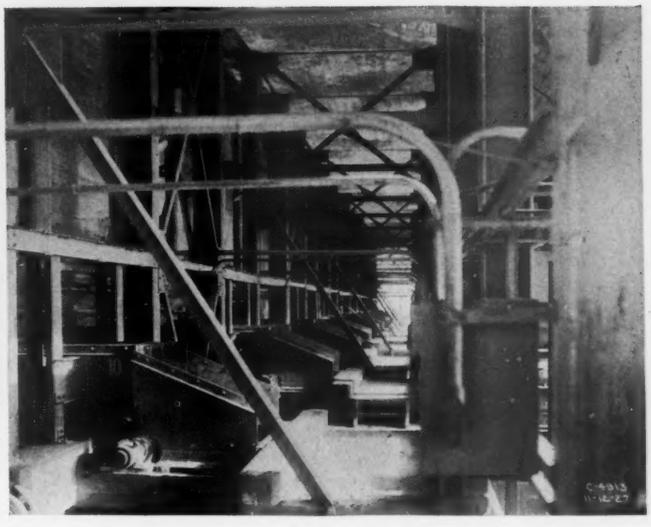


Fig. 3. The battery of feeders, showing only the head ends projecting out from under the concrete bins

charging stone and several others about ready to go into action. One operating house is shown under the third pair of spouts, and a portion of another may be seen. View number two is a close-up of the discharge end of one of the apron feeders, showing a baffle plate below which protects the belt by breaking the force of the fall of the stone.

View, Fig. 3, gives a general view of the head ends of the battery of apron conveyors, and also shows the relation of the bottoms of the old and new storage bins.

As a result of the quicker loading obtained from this installation over the former gravity discharge, the older bins are now used only for reserve storage. In the event more than one ship arrives for a cargo at about the same time, and the supply in the new bins is insufficient, the old bins are drawn upon after the new ones are emptied. This does not occur often and consequently the great bulk of the tonnage is handled by the conveyors.

New Investigation of the Law of Crushing

THE LAW OF CRUSHING, the relation between the power used in crushing and the fineness of the material produced, has been a subject of controversy for many years. The oldest and most popular theory is that the work is proportional to the fresh surface exposed, as would be the case if one were to cut up a cake of soap with a knife. The opposition held that the work was that required to deform the object beyond the elastic limit, a force that might be measured in a testing machine. The first theory is known as Rittinger's law, the second as Kick's law.

The controversy seemed to be settled in favor of Rittinger's law about two years ago, when Dr. Geoffrey Martin published the work he had done for the Association of British Portland Cement Manufacturers. This was abstracted in ROCK PRODUCTS, February 19, 1927. The success of his work lay in the method he devised for measuring the surfaces exposed by crushing, which was by dissolving samples of the material (quartz) before and after crushing for a given length of time in hydrofluoric acid and determining the amount lost by dissolution in each case. He assumed that the amounts going into the solution were proportional to the surfaces exposed. It now appears that this assumption was close enough to give a correct conclusion as regards the law of crushing, although it was not entirely correct in itself.

A more accurate method was developed by the investigators of the Bureau of Mines, U. S. Department of Commerce, who had been working on the law of crushing for some time. Their results are given in "Crushing and Grinding Studies of Quartz," Serial 2880, July, 1928. The authors are John Gross and S. R. Zimmerly, metallurgist and assistant metallurgist of the Bureau. They too saw the necessity of an accurate method for determining the fresh surfaces exposed in crushing and measured various surface actions, such as the adsorption of new surfaces and the heat of wetting. But all were discarded in favor of a method somewhat similar to that used by Dr. Martin, that of dissolving samples of crushed and uncrushed quartz in hydrofluoric acid. With this important difference, however, that instead of determining the quantity dissolved they determined the initial rate of dissolution.

This was necessary because the rate changes as solution goes on, which is due to a change in the concentration of the acid and to a change in the surface acted upon. But by plotting the rate at which the quartz went into solution at different periods of time, a curve was obtained which could be carried out to a point representing the *original* rate of dissolution, what it was at the start and before there was any change in the concentration of the solution or in the surface of the solids. Comparison of the initial rates of the crushed and uncrushed material gives a true measure of the surfaces exposed.

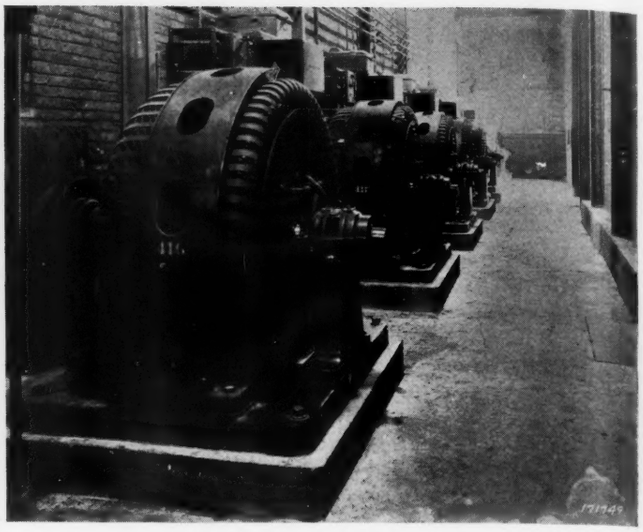
The greater part of the paper is given to an explanation of the method and the manner in which it was checked and verified. But the important fact to the non-technical reader is that by the use of this method the investigators found that the Rittinger law correctly expresses the work done in crushing; that is, the new surfaces produced are in direct proportion to the work input.

This also applies to the method of measuring the work done, which was as simple as possible. The quartz was placed in a mortar and a metal ball was dropped on it from a definite height. To avoid the rebounding of the ball, the mortar was placed on three pieces of aluminum wire and the work done was calculated by measuring the deformation of the wires, caused by the falling of the ball in the mortar.

Very interesting figures for the relationship of size and surface for different mesh sizes of crushed quartz were developed, and these will have a wider application than that of crushing experiments. It was found that the actual new surface due to crushing was greater with the larger particles, and this is on account of cracking and the production of interior surfaces. But as these take work to produce, the same as exterior surfaces do, they were rightly measured by the method used.

A special study was given to the minus 200-mesh particles. Usually it is assumed that these have an average diameter of 0.037 mm., or one-half the opening of a 200-mesh screen. It was found that this assumption was quite incorrect. The highest and the lowest average values found for minus 200-mesh crushed quartz were 0.018 mm. and 0.005 mm., and the exposed surfaces for these were found to be 2034 sq. cm. and 7065 sq. cm. per gram.

A group of tubemill drives employing belted motors gave good service for many years



The same room as shown in the opposite picture after installation of slow-speed synchronous motors

Trends in Cement Mill Electrification

By M. A. Hyde

General Engineer, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn.

THE closing year has witnessed numerous extensions in the uses of electrical equipment in the cement and other rock products industries. The principal lines of development exhibit a tendency toward greater mechanical simplicity and further emphasis of constructional features adapting the equipment to care-free operation under particularly severe service conditions.

Since the beginning of cement mill electrification, motor drive has been characterized by the possibilities it offers for directness in mechanical layout. Simplicity, with its related low maintenance and attendance cost, reliability, and safer working conditions, may be of as much importance in overall operating economy as mechanical or electrical efficiency.

Improved Salient Pole Type Synchronous Motor

As a further development in this trend toward the greatest possible mechanical simplicity, an improvement in the salient pole type of synchronous motor is worthy of note. The synchronous motor has for some years been an accepted type for large tubemill drives, not merely because of its desirable power factor characteristics but primarily because of its adaptability to low speed construction, enabling it to be coupled directly to the mill pinion shaft without any intermediate drive.

Heretofore, special mechanical features have commonly been employed in connection with or as a part of this type of motor, so as to make it possible to start the motor unloaded and synchronize it before taking up the load. Another type that has been employed in this country is the synchronous induction motor, long common in European practice on drives of this sort. But the past year marks the first installation of low speed salient pole type machines ever to be directly coupled to the tube-mill pinion shaft without the use of a magnetic or mechanical clutch or the equivalent. The new motors, developing the required high starting and pull-in torques entirely electrically, thereby employ the simplest mechanical construction ever used in low speed high torque synchronous motors of the well known and highly efficient salient pole type. Fig. 1 shows a 600-hp. motor of this construction, one of an installation of six units driving compartment tube mills. A 300-hp. belted motor of this form is in service on a 66-in. x 86-in. jaw crusher in a limestone quarry, a drive ordinarily handled by an induction motor of the phase-wound-rotor type.

Continuous Labor-Saving in Operation

Although the cement industry is one of the most highly mechanized lines of manufacture, still labor is an important item in the total cost of production, and im-

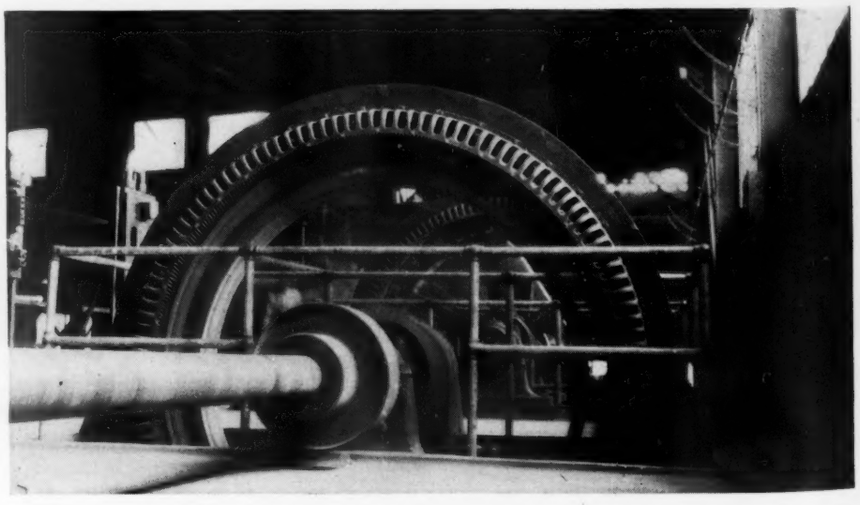


Fig. 1. A 600-hp. high-torque synchronous motor driving a compartment mill

provements in electrical practice are continually under way both toward facilitating plant operation and minimizing electrical maintenance work. From the operating standpoint, electrification affords the ultimate in convenience of machinery layout and control. Magnetic control is employed increasingly, not particularly to spare the little time and effort occasioned by the infrequent starting and

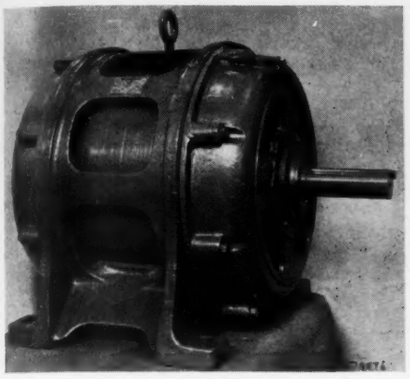


Fig. 3. Totally-enclosed fan-cooled motor

stopping of most cement mill machinery, but primarily as a means of reducing control manipulation to the simplest terms. This puts increasingly larger portions of the mill into the hands of single operators. The most modern plants impress one simultaneously by the prevalence of electric push buttons and the relatively few attendants. Fig. 2 shows how by the convenient location of master push buttons the entire crushing department for a modern 5,500-bbl. cement plant is controlled from one central location.

Two examples will typify the development toward minimization of maintenance on electrical equipment. One is the introduction of the totally enclosed fan cooled motor and the other the increasing use of line-starters, particularly of the oil immersed type, for induction motors.

Totally Enclosed Motors

For the majority of cement mill drives where induction motors are used, the usual open type of construc- has served and will continue to serve very adequately. There are some few applications, however, where dust carried through the motor windings by the rotor fans has caused abrasion of the insulation. This is particularly true where the motors are exposed to a more or less direct precipitation of gritty semi-ground material. Small ratings are so exposed more often than the larger units because being small in size they are more likely to be placed in out of the way and less favorable locations.

Motors simply totally enclosed are quite economical in small ratings, but since in this type all the losses must be radiated as heat from the outer surface, in sizes above 7½ or 10 hp. the necessary surface area leads to frame sizes so large as to be extremely costly. Piping of ventilating air to motors in such locations is generally impractical because there is no supply of clean air convenient, all aside from the expensive and troublesome system of ducts involved. The latest development along these lines is the fan-cooled, totally enclosed motor. As will be seen in Fig. 3, this motor has the same general outside

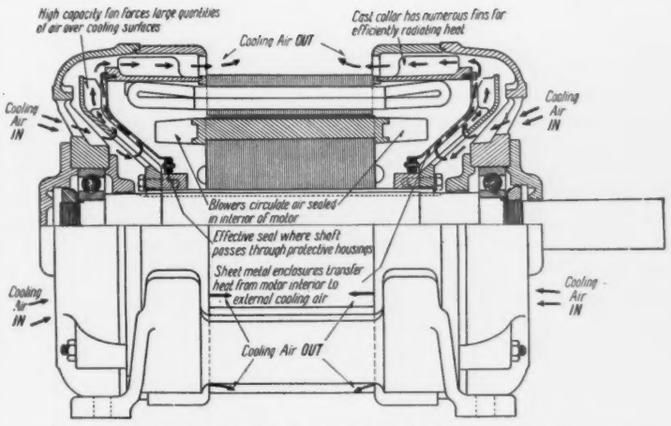


Fig. 4. Sectional view of totally-enclosed fan-cooled motor

appearance as the standard open-type motor, and it is of practically the same dimensions. But Fig. 4, giving a sectional view shows that all the windings are entirely enclosed in a metallic housing, so that the outside air used for cooling never comes in contact with the motor windings,

Fig. 5. Two 7000kv-a transformers in the substation of the Lawrence Portland Cement Co., Siegfried, Penn.

but is drawn in by a fan at each end of the motor, over the surface of the winding housing and discharged across the back of the motor frame. Ball bearings are used, to eliminate end play and maintain close clearances between the fans and housings.

Increasing Use of Line-Starters

The increasing use of line starters for squirrel-cage motors is in the direction of maintenance reduction through the use of equipment of the simplest form. The line starter consists merely of a magnetic contactor bush-button operated, with overload protection by a bi-metallic thermal relay. A special form has been developed in sizes up to 60 hp. for cement-mill and similar services, wherein the contactor as well as the contacts of the overhead relay

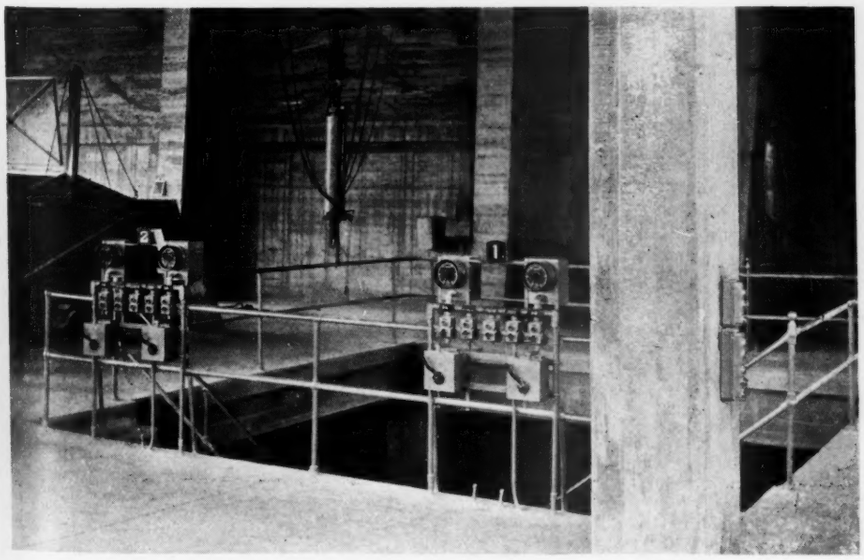


Fig. 2. Push buttons control motors from car dumpers to the final conveyor in this crushing plant

are immersed in a tank of switch oil. All current contacts are thereby kept clean and cool by the oil, enabling the starter to carry on under the most adverse conditions of dust, overload and long continued operation without attention.

Increasing Use of Electric Shovels

The value of electric drive in some of the more special phases of cement mill mechanization is well shown in the increasing use of electric shovels in quarry practice. One cement plant, after installing two 1½-yd. electric shovels to replace two steam shovels, reported for the twelve months ending July 31, 1928, a stone tonnage handled of 617,148 tons at an operating cost (labor, power and lubrication) of $0.023 per ton, as against 549,610 tons handled in 1926 with the steam shovels at an operating cost (labor, fuel, and oils) of $0.063 per ton. This saving, even neglecting reductions in maintenance expense, would amount to the total installed cost of the new electric shovels in a little over three years.

Arc Welding Repairing

For the variety of repair and construction work that continually goes on in a cement mill, the convenience and economy of modern welding equipment is being signally demonstrated. In the past year electric welding has been extended as a structural practice, in the construction of buildings and even bridges, and it now forms the basis of manufacturing practice in the production of many lines of electrical machinery. The synchronous motor shown in Fig. 1 is of the welded structural type. It is interesting to note that this method of construction has extended to electrical machines of very large size. The princpal advantages of this welding practice lie in the ready accessibility of basic material of well known and uniform properties in standard shapes and sizes, and freedom from the familiar hindrances in castings practice. A 5,000 hp. 82 r.p.m. synchronous motor—which by the way has a frame diameter of 26 ft.—has been just completed at the time of this writing, designed and built from the ground up on a delivery schedule of ninety days. This would have been very difficult to accomplish with the old order of cast construction. The possibilities of electric welding are in no wise limited to the construction of electrical machinery, and it is believed that they could well be utilized to a greater extent by manufacturers of cement-mill machinery.

Waste-Heat Power Developments

In the power department of cement-mill activity, new and interesting installations are continually being made. The substation of the Lawrence Portland Cement Co., Siegfried, Penn., has an installed transformer capacity of 14,000 kv-a. and is believed to be the country's largest substation in the cement industry. Fig. 5 shows the transformer equipment in this station.

The number of waste-heat operated plants is steadily increasing. An installation of interest is the new Boettcher, Colo., plant of the Colorado Portland Cement Co., where the 6,250 kv-a., 80% p.f., 2,300-v., turbo-generator operates under the very interesting load conditions stated recently* to be those of an average plant load of 3,612 kw., wth an average power produced of 4,400 kw., the surplus power being sold to the Public Service Co. of Colorado, with which a tie-in is effected under a reciprocal agreement allowing the cement company to take power from the outside lines when it becomes necessary for any reason, and in turn, any excess power is sold to the power company. As indicated above, under normal conditions, the waste-heat plant provides all the power required to run the mill and we are informed that as much as 24,000 kw. hrs. in a day's time have been delivered to the power company.

An eastern plant of interest is that of the Nazareth Cement Co., where waste heat equipment going into service includes two 4,375 vv-a. turbine generators, 80% power factor, 600 volts.

The present divergence between production and productive capacity indicates to the cement mill engineer not a surcease from his activities, but merely a temporary change in their direction. Aside from a few cases where peculiarities of location or other unusual conditions obtain, the demand for production has been, for the time, amply met. So the engineer will increasingly devote himself to effecting the production of cement not primarily in greater quantity, but with even greater economy. And here electricity will play a vital part, as it has played in the past progress of the industry.

*See article by P. C. Van Zandt, *Power*, August 7, 1928, "Surplus Power from Waste Heat Sold to Central Station."

Washing Sand and Gravel in England

"SAND AND GRAVEL for concrete should be washed absolutely clean and free from everything that can be dissolved in water or that can be washed away in clean water," is the way O. Rikof begins his paper on sand and gravel washing which was read at the Institute of Quarrying meeting at Blackpool, England. He says he is prepared to prove that clay in the aggregate is the surest and the commonest cause for the disintegration of concrete paving, and that (in England) some "experts" try everything, such as the use of extra reinforcing and expansion joints, to avoid disintegration, but these fail if clean aggregate is not used. And many commercial sand and gravel plants, he says, do not produce really clean material as it should be cleaned.

Discussing the washing process, Mr. Rikof says that it is much better to hand pick the larger lumps of clay rather than to try to remove them by washing. Most American operators will agree with this, for they have found hand picking of clay lumps profitable even where the pickers get almost the wages of skilled mechanics. Where clay is troublesome he advocates the use of specially designed washing cylinders, and the better plants of the United States use these if there is much clay to contend with.

He notes one point which he rightly says is often overlooked in sand washing, the disposition of sand falling through clayey water to pick up clay as it descends. It is for this reason that automatic sand settlers which hold no body of clayey water will give a cleaner product than large bins used as settlers.

Elements of a Sand and Gravel Washing Plant

Mr. Rikof states the necessary elements of a sand and gravel washing plant are:

(*a*) An automatic feeding device, which guarantees a uniform washing and positive output.

(*b*) A revolving washing cylinder of sufficient dimensions to easily handle the guaranteed quantity.

(*c*) A set of screens concentrically arranged for thoroughly grading that quantity.

(*d*) Water pipes for supply to the washer and sprays for cleaning the various grades of gravel and sand.

(*e*) An elutriator for recovery of all sand, and separating the washing water containing the clay, etc., in suspension.

(*f*) A sediment separator or cone for separating the last trace of sediment with the final cleansing water.

A plant with these elements would certainly deliver clean material if not overfed, but the necessity of putting all of them into every plant is debatable. There are many deposits of material so clean as to require no passing through a washing cylinder. In the United States screens in series are preferred by many operators to the concentrically arranged (jacketed) screens which are said to be necessary. The elutriator is any device washing with an upward current of water, more often called a classifier, and such devices have not been much used in sand washing, although their use is growing. By a sediment separator is meant a drag, screw or elevator classifier, according to an explanation given in a later paragraph.

In concluding his paper Mr. Rikof calls attention to the common error of looking upon a centrifugal pump as a washer. He says that it delivers the material in about the same condition that it receives it, and many operators who have had occasion at one time or another to test sand and gravel pump discharges will confirm the truth of his statement.

Synchronous Motor Demonstrates Its Suitability to Severe Crusher Drive

By S. P. Bardeau
Electric Machinery Manufacturing Co., Minneapolis, Minn.

A HAMMERMILL INSTALLATION at the plant of the Diamond Portland Cement Co., at Middlebranch, Ohio, is of unusual interest. It demonstrates not only the advantages but also the entire suitability of a synchronous motor direct-coupled (without clutch) to a mill having severe crushing duty. It illustrates the progress that has been made, by specialized design and automatic control, in adapting the synchronous motor to cement-mill drives, hitherto considered not suited to its use. The synchronous motor at the Diamond Portland Cement Co. plant represents the first direct-coupled (without clutch) application to a hammermill crusher in a cement plant.

In replacing a gyratory crusher used for crushing limestone with a Jeffrey hammermill, the plant engineers, with a view to cutting operating costs to a minimum, made careful investigation to obtain a drive most efficient from all standpoints. After determining the duty imposed by the hammermill, a synchronous motor, designed to the duty, was applied. The result was thoroughly satisfactory performance and a material reduction in the cost of power for crushing.

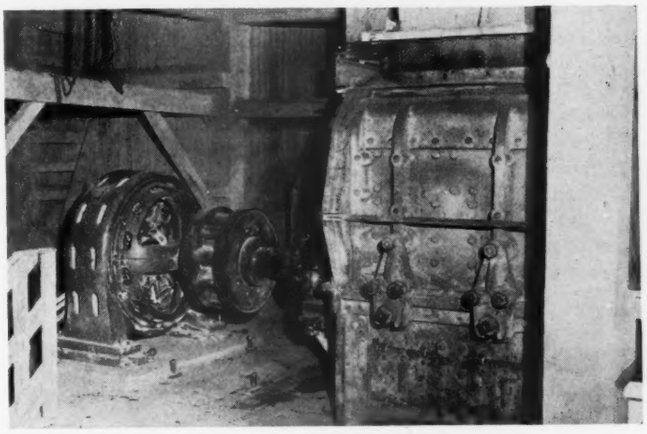
Reasons for Replacement of Gyratory Crusher

The following data, giving the reasons for replacing with hammermill the gyratory crusher used for crushing limestone, and the comparison of operation, was supplied by the engineers of the cement plant. The replacement was made, first, to reduce the size of the crushed material; second, to decrease the time required to crush the desired amount of material in wet weather; and, third, to decrease the time and cost of drying the material for pulverizing.

The gyratory crusher installation formerly used consisted of one No. 9 gyratory, with a revolving screen, and one No. 6 gyratory. This method of crushing passed the material through a mesh of 2 in. with about 30% of the material fine enough to pass ½-in. mesh. The crushed material was not as fine as desired, and in wet weather the gyratory easily and frequently clogged, so that the material did not flow readily. This necessitated frequent cleaning of the crusher, with an attendant slowing down in production, so that the limestone now handled in 10 hours on the hammermill crusher frequently took from 30% to 40% longer with the gyratory crusher.

The hammermill handles the quarry run of rock loaded by a 1¼-yd. shovel, is operated 10 hours per day, and crushes on the average 750 tons of limestone per 10-hour day. The mill, however, could easily handle 1000 tons daily and is able to turn out 750 tons when the material is sticky and wet, with hardly any more trouble than when dry.

In addition to reducing the time required to obtain the same production, a greater advantage of using the hammermill arises from the greater pulverizing of the material. This shortens the time required to dry the material preliminary to its being ground in the tube mills and, of course, enables quicker grinding in the tube mills, thus increasing their capacity. With hammermill crushing, the maximum size of the crushed material is approximately 1¼-in. and about 60% of the material will pass a ¼-in. mesh.



Synchronous motor of 250 hp., for unity power factor operation, running a 54x48-in. hammermill having a capacity of 125 to 150 tons per hour

Another advantage of the hammermill crusher over the former gyratory installation is the need of one less attendant in the crushing operation, and the fact that there were three motors on the gyratory installation, so that the hammermill with a single motor eliminates the necessity of maintenance for two motors. Although the gyratory installation is not to be removed, it is evident from an inspection of the plant that the foundations and the building could have been much smaller and less expensive had the initial installation been a hammermill. The hammermill hammers are good for approximately 75,000 tons of material, or about four months' operation.

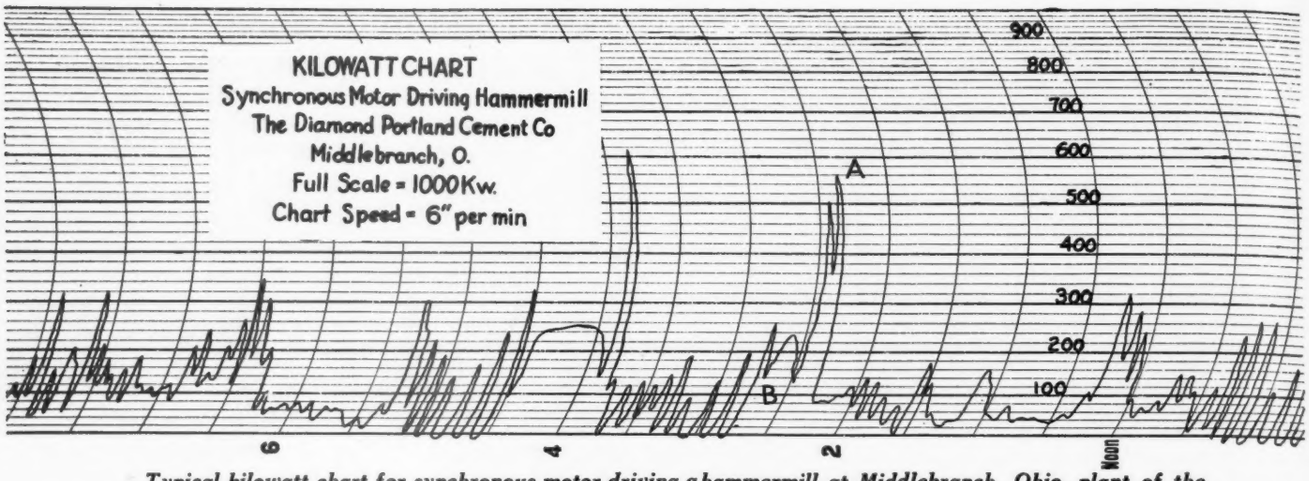
Reasons for Selection of a Direct-Coupled Synchronous-Motor Drive

In selecting a drive for the hammermill crusher the cement plant engineers had the option of using either a squirrel-cage or wound-rotor induction motor, both of which had previously been standard for this drive.

A big objection to an induction motor was the matter of power factor. Power is obtained from the Ohio Power Co., which has in its power-rate schedules a forceful power factor clause. Increased slip under heavy loads, which means reduced speed, was also an objection to an induction motor, since it directly affected the quantity and quality of output. Another objection to an induction motor was the small air gap, which made it necessary to keep close watch on the bearings, and inasmuch as the motor works in an extremely dusty location, this would undoubtedly have been an item of some importance.

Principally because of power-factor considerations a synchronous motor was decided upon as the most suitable drive. On a drive of this type the motor works at part load a considerable part of the time. With an induction motor this would have resulted in a low, lagging power factor. With the synchronous motor, part load results in leading power factor operation, which tends to keep the power factor of the whole plant higher. A standard synchronous motor with clutch was first considered, but because of the cost of the clutch as compared with the cost of the motor, it was finally decided to apply to this drive a specially designed, high torque, synchronous motor, the performance of which was guaranteed.

The drive presented characteristics which heretofore have made it considered wholly unsuitable for synchronous motor application. One was the high starting torque; another, the unusually long time to get up to speed, due to the extremely great flywheel effect of the hammermill rotor. A third was the high instantaneous peak loads, which would tax the pull-out characteristics of the usual synchronous motor. The time required



Typical kilowatt chart for synchronous motor driving a hammermill at Middlebranch, Ohio, plant of the Diamond Portland Cement Co.

to start and get the hammermill up to speed is approximately 50 seconds.

The synchronous motor applied to this drive is a 250-hp., unity power factor, 40 deg., 720-r.p.m., high-torque motor. The motor is equipped with a double squirrel-cage winding on the rotor, which insures sufficient starting and pull-in torque and gives a comparatively low starting current inrush, or starting kv.-a. The motor was given a high pull-out torque characteristic to enable it to successfully handle the majority of instantaneous peak loads. It was not designed, however, to handle infrequent very high peak loads. When such conditions pull the motor out of step (out of synchronous speed), the frequency relay control furnished with the motor immediately removes direct-current excitation from the motor field. The removal of direct-current excitation permits the motor to automatically resynchronize when the peak load passes.

The field switch on the starting panel of the synchronous motor is interlocked with an automatic control on the d.c. motor driving the conveyor, which dumps the rock into the hammermill, so that when the synchronous motor is pulled out of step the supply of rock is automatically stopped until the motor synchronizes again. Such an operating condition is shown in the chart, Fig. 3. An unusual peak encountered at point *A* pulled the motor out of step. The excitation was immediately removed and the conveyor motor stopped, thus permitting the motor to automatically resynchronize at point *B*, 10 seconds later. The mechanical design of the motor was made rugged to withstand the vibration and load variation in this type of drive. The graphic ammeter chart shows the load variation imposed upon this motor.

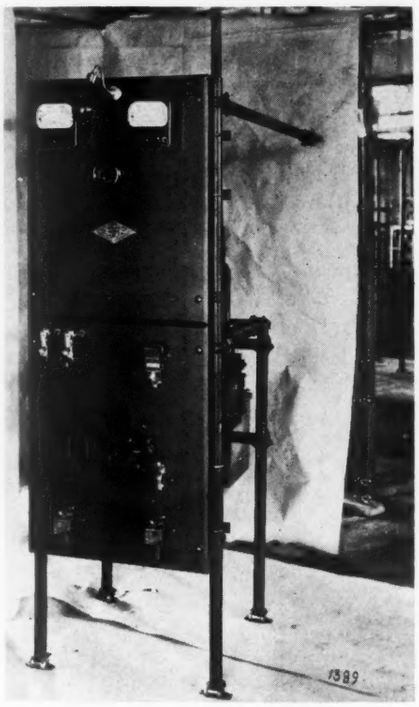
Advantages of New Type of Drive

The synchronous motor has been in successful operation since installation in June, 1927, and its advantages to the user may be recounted as follows:

POWER FACTOR CORRECTION: The motor improves the plant power factor approximately 1%, with the large total plant kilowatt-hour consumption and the power-factor clause in effect enables a material saving in power cost.

LESS MAINTENANCE: Because of the large air gap inherent to the synchronous motor, there is need for much less maintenance on the bearings. With the induction motors formerly used on the gyratory crusher it was necessary to inspect the air gap and renew bearing oil once every six weeks. Inspection of the synchronous motor is made only at the end of the operating season.

CONSTANT SPEED: The absolutely constant speed obtained by the use of the synchronous motor is obviously an advantage. Absolutely constant speed materially improves the quality and increase quantity of crushed material due to the maintained hammer speed which insures a constant impact from the hammers in crushing.



Full-voltage, oil break, frequency-controlled starter, 2500 volts, for use with 250-hp. synchronous motor operating hammermill

FULL-VOLTAGE STARTING: An automatic full-voltage starter is used. The starter is of the frequency relay type which operates to apply direct current field excitation at an exact predetermined motor speed.

Ordinarily a reduced-voltage starter would have been used with a motor of this size and speed. Full-voltage starting was recommended however, and used. The advantages are: (1) Elimination of a second peak current inrush, or "bump on the line," which takes place in reduced voltage starting when the motor is thrown from reduced to full voltage. The full-voltage starting used on this motor, which gives the line only one "bump" in starting, is very satisfactory to the power company. (2) Decreased period of acceleration, or time for the motor to reach synchronous speed. (3) Simplified starting equipment and reduced maintenance. (4) Reduced first cost of starting equipment.

Sodium Salts

NATURAL SODIUM SALTS, notably sodium sulphate, sodium borates, trona, carbonates and bicarbonates, are recovered from quarries and open pits in the arid regions of the United States, especially in the desert portions of California and Nevada. The deposits are for the most part sedimentary and are residual matter from evaporation of saline lakes. Several sodium salt deposits are at various stages of development in New Mexico and Washington, the latter state's production being mainly from the deposits of The 99 Co., near Okanogan.

The following table shows value and tonnages of natural borates:

Year	Short tons	Value
1923	136,650	$3,994,790
1924	116,110	3,183,910
1925	113,700	3,085,660
1926	115,970	3,128,110
1927	109,080	3,473,399

New Machinery Developments

MACHINERY MANUFACTURERS serving and equipping the rock products industries generally report an excellent year and expectations of another equally good. If one has read the preceding reviews of the major rock products industries he must have been impressed with the tremendous efforts being made by producers to modernize their plants in every possible way.

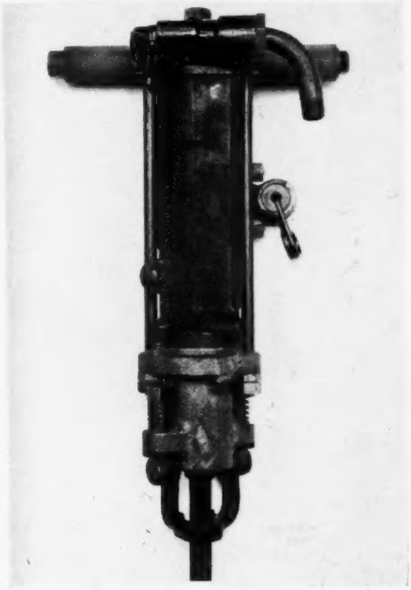


Fig. 1. New complete line of compressed air drills

Explosives

The chief event in the explosives industry was the establishment of several liquid oxygen plants in connection with quarry operations. The establishment of a liquid oxygen (L.O.X.) explosive plant at the operation of the Michigan Limestone and Chemical Co., Calcite, Mich., by the Air Reduction Sales Co., New York City, is referred to elsewhere in our review of the crushed-stone industry. The Keith Dunham Co., Chicago, Ill., has been equally active and after several blasts at the Dolese and Shepard Co. plant near Chicago with oxygen made at a commercial plant has built a plant at the quarry.

The use of liquid oxygen has certain disadvantages in that it cannot be stored for any length of time, hence the quarry operation must be large enough to be using explosives continually, or there must be a group of co-operating quarries, which can use the L.O.X. as fast as made. Also, of course, the common method at many quarries of blasting but once or twice a year with very large charges would have to be changed, if L.O.X. were adopted.

There does not appear to have been anything new in dynamite explosives during the year other than a series of dynamites of high cartridge count developed by the Hercules Powder Co., Wilmington, Del., under the trade name "Hercomites." They are different from ordinary dynamite through having a standard weight strength while their cartridge or working strength is obtained by varying the cartridge count. Effective working strengths of from 20 to 60% are thus obtained. It is claimed that the greatly increased number of cartridges per 100 lb. results in appreciable economy. The fumes permit underground use.

Drills and Drilling Accessories

The Loomis Machine Co., Tiffin, Ohio, in June announced a new well drill with four crawler wheels for work on particularly soft ground (ROCK PRODUCTS, June 23).

Early in the year the Chicago Pneumatic Tool Co., New York City, added to its long line of compressed-aid drills a drifter drill especially designed for hard rock (ROCK PRODUCTS, January 21).

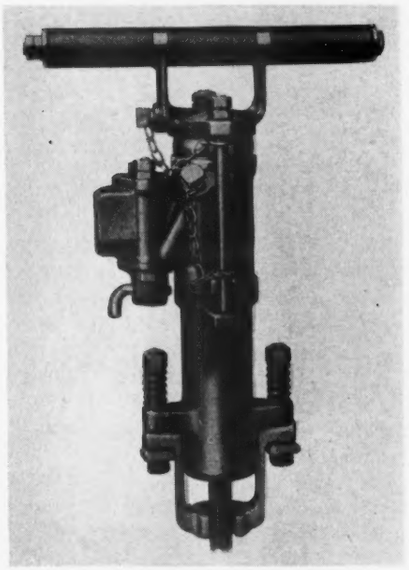


Fig. 2. A compressed-air drill developed in 1928

The Milwaukee Gas Tool Corp., Milwaukee, Wis., developed a new gasoline hammer drill under the trade name "Rodax" (ROCK PRODUCTS, March 3).

A new line of drifter drills was announced in August by the Ingersoll-Rand Co., New York City. There are three sizes in all, 185-lb., 138-lb. and 110-lb. (ROCK PRODUCTS, August 18). This company's well-known line of "Jackhamer" drills was further perfected in 1928. These are now made in three standard sizes, 43-lb., 57-lb. and 72-lb., respectively. The special features of the new drills are: Elimination of valve chest on side of cylinder; use of I.-R. "flapper" valve; throttle in handle; bushed-type rotation sleeve; swivel air connection and new steel holder to eliminate wear on fronthead. They are made in dry, wet and blower type—the latter particularly for deep holing in soft, heavy ground where continuous blowing is necessary for cleaning the hole rapidly. The 43-lb. drill is designed for general mine and quarry work, "pop-holing," etc. The 57-lb. is designed for shaft sinking as well as quarry work. The 72-lb. drill is designed principally for deep, down-hole work, both in shaft sinking and quarry benching. The new "Jackhamer" is shown in Fig. 1. The Ingersoll-Rand Co. also has brought out a new "paving breaker," designed for high

Fig. 3. Oil furnace for drill steel

Fig. 4. Oil furnace for drill steel

speed and low air consumption.

The year's developments of the Sullivan Machinery Co., Chicago, Ill., include a new core drill for testing concrete (Rock Products, March 31); a substitute for diamonds in core drills, "Sulamite" (Rock Products, December 8); a new line of "Rotator" hammer drills, of the type shown in Fig. 2. They are made in both dry and water classes, designed "to meet the call for a light, powerful, one-man drill under conditions requiring a blow of moderate strength, coupled with rapid, powerful rotation, securing excellent hole cleaning ability." It has automatic rifle-bar rotation, an improved drill-steel retainer, improved automatic rotation and is claimed to have low air consumption per foot of hole drilled. It weighs 39 lb. This company has brought out a new "concrete breaker," weighing 84 lb., which is equipped with a striking block to transmit the blow of the piston to the shank of the "buster" tool.

The Gardner-Denver Co., Denver, Colo., brought out a new small size drill-steel sharpener (Rock Products, September 29). All three companies brought out new high pressure oil forges for heating drill steels.

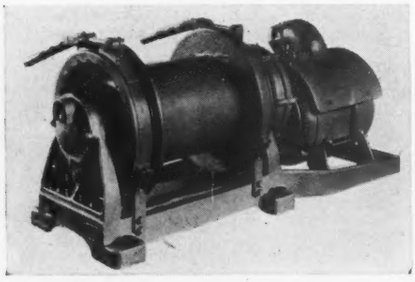


Fig. 55. A 10-hp. portable electric hoist

That of the Gardner-Denver Co. was described in Rock Products, September 15. That of the Ingersoll-Rand Co. is illustrated in Fig. 3. The Sullivan drill forge is illustrated in Fig. 4.

Hoists and Cranes

THE American Engineering Co., Philadelphia, Penn., announced a "Quick-Lift" all-steel, ¼-ton electric trolley hoist (Rock Products, January 21) and later (Rock Products, May 12) a new Lo-Hed hoist. The Dobbie Foundry and Machine Co. and the Mundy Sales Corp., New York City, developed a new Dobbie full-rotating derrick (Rock Products, March 3). The American Hoist and Derrick Co., St. Paul, Minn., brought out a new high-speed, two-drum, electric hoist.

The General Electric Co., Schenectady, N. Y., introduced a new line of solenoid brakes for hoists (Rock Products, September 1). The R. H. Beaumont Co., Philadelphia, Penn., announced a new skip hoist (Rock Products, September 25). The Cleveland Crane and Engineering Co., Wickliffe, Ohio, designed an arc-welded traveling crane (Rock Products, September 15). The Chisholm-Moore Hoist Corp. produced a new direct differential chain hoist (Rock Products, September 29).

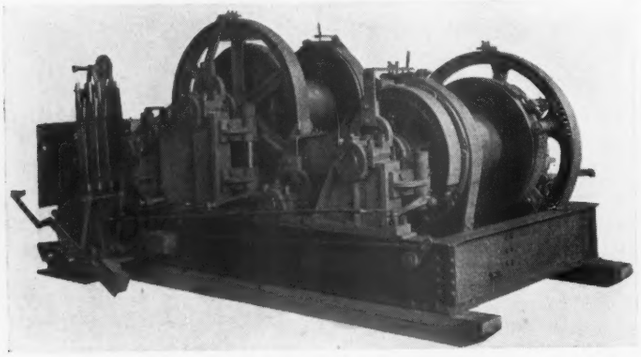


Fig. 54. Slack-line, two-speed hoist for gravel plants

The Ottumwa Iron Works, Ottumwa, Iowa, recently placed on the market a new two-drum, variable speed hoist (Rock Products, October 13). The Weller Manufacturing Co., Chicago, Ill., brought out a new capstan type car puller (Rock Products, November 10). The Chicago Pneumatic Tool Co., New York City, announced a new line of "CP" air hoists, embodying several new and distinctive features (Rock Products, November 11). Foot Bros. Gear and Machine Co., Chicago, Ill., entered the hoist field with a new type of electric car puller (Rock Products, November 24).

Street Bros. Machine Works, Chattanooga, Tenn., developed a slack-line, two-speed, excavator hoist (Fig. 54). The two speeds are on the front drum only, the back drum being used for tightening the track cable, always operates at low speed, enabling the track cable to be raised after the bucket is out of the cut and the lower drum thrown over to high speed. It is made for electric, steam or gasoline.

The Sullivan Machinery Co., Chicago, Ill., have extended its line of portable electric hoists (Fig. 55) to a range of from 10 to 35 hp., in both single- and double-drum models. The new single drum 10-hp. hoists are particularly used as far pullers. It is claimed to lift 1650 lb. with a single line on direct pull at a rope speed of 200 ft. per minute. A 25-hp. hoist is shown in Fig. 57.

The S. Flory Manufacturing Co., Bangor, Penn., is bringing out a new line of hoists known as the "Flor-Ox." The first of the series (Fig. 56) is equipped with either a 35-hp. electric or gasoline motor. Clutches and brakes are asbestos lined. The main gears and pinions have cut teeth. A silent chain motor drive is enclosed in a dustproof housing. The clutch operating mechanism is provided with a roller bearing thrust, eliminating the old friction screw and nut. The friction lever is equipped with a positive release device. This hoist can be altered in the field from a single- to a double- or triple-drum by bolting units together. A boom swinging attachment can also be furnished. It has Alemite lubrication and is designed to lift 5000 lb. at 165 ft. per minute.

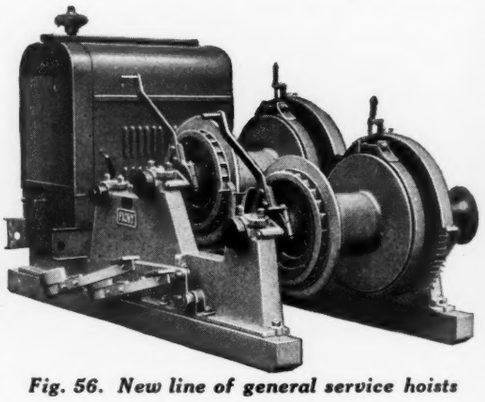


Fig. 56. New line of general service hoists

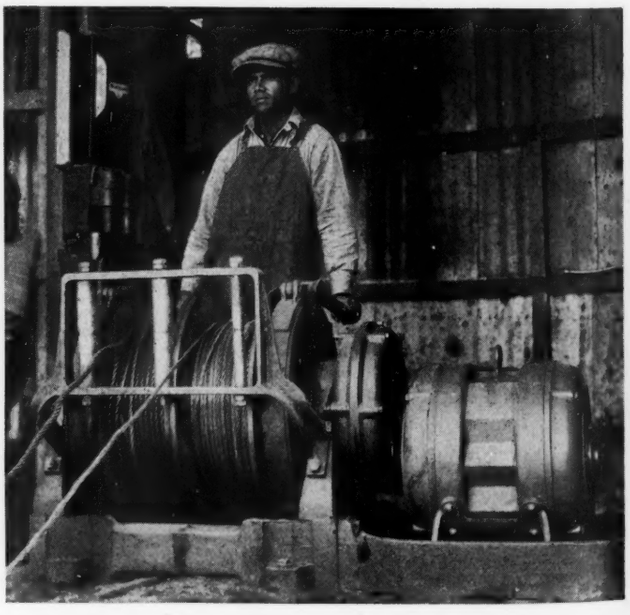


Fig. 57. A 25-hp. power portable electric hoist at quarry

Excavating Machinery

THE keenest kind of competition exists in the power-shovel and excavator field. Every year sees almost as many "new models" as the automobile industry. The year 1928 was no exception, although some of these new models are withheld from public announcement for the annual January Road Show.

We find the first notice of the year in ROCK PRODUCTS, January 7, of a new 1-yd. shovel by the Ohio Power Shovel Co., Lima, Ohio. Also early in the year the Northwest Engineering Co., Chicago, Ill., announced a pull-shovel scoop (ROCK PRODUCTS, February 4). The Northwest Engineering Co. also brought out a new fairlead for its draglines (described in ROCK PRODUCTS, April 14).

In June the Bay City Dredge Works, Bay City, Mich., announced a new ¾-yd. revolving convertible shovel, crane and trencher (ROCK PRODUCTS, June 9).

The Speeder Machinery Co., Cedar Rapids, Iowa, brought out a new convertible ½-yd. shovel and trencher (ROCK PRODUCTS, June 23).

A new 2-yd. convertible shovel, dragline, was one of the year's contributions of the Link-Belt Co., Chicago, Ill. (ROCK PRODUCTS, July 21). The Link-Belt Co. also developed a digging elevator, which can hardly be classed as an excavator, although it really is a fixed bucket excavator, for digging sand, gravel, etc., out of plant elevator sumps (ROCK PRODUCTS, January 7).

The Insley Manufacturing Co., Indianapolis, Ind., announced a full revolving excavator with five different attachments (Rock Products, August 18).

H. D. Conkey and Co., Mendota, Ill., placed on the market a convertible crawler crane in ½-yd., ¾-yd. and 1-yd. sizes (ROCK PRODUCTS, September 1).

The Universal Crane Co. and the Thew Shovel Co., Lorain, Ohio, recently announced a new ½-yd convertible shovel crane (ROCK PRODUCTS, December 8).

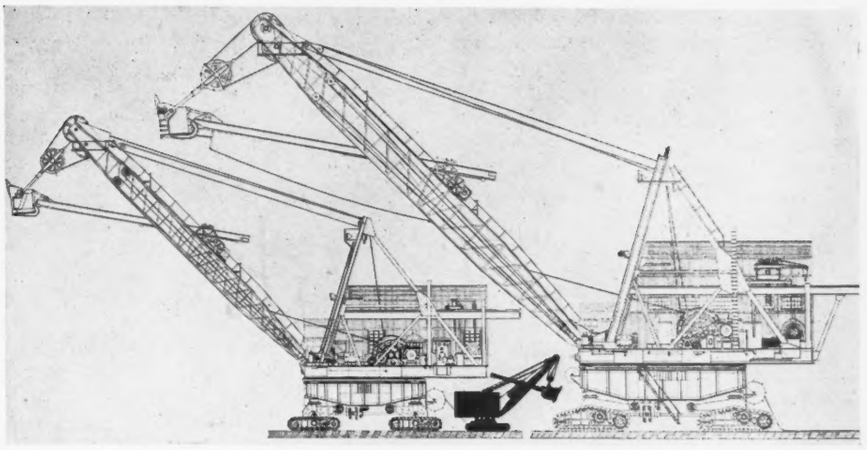


Fig. 5. A 1550-ton, 15-yd., electric shovel compared with an 850-ton 12-yd. and a 1 1/4-yd. standard shovel

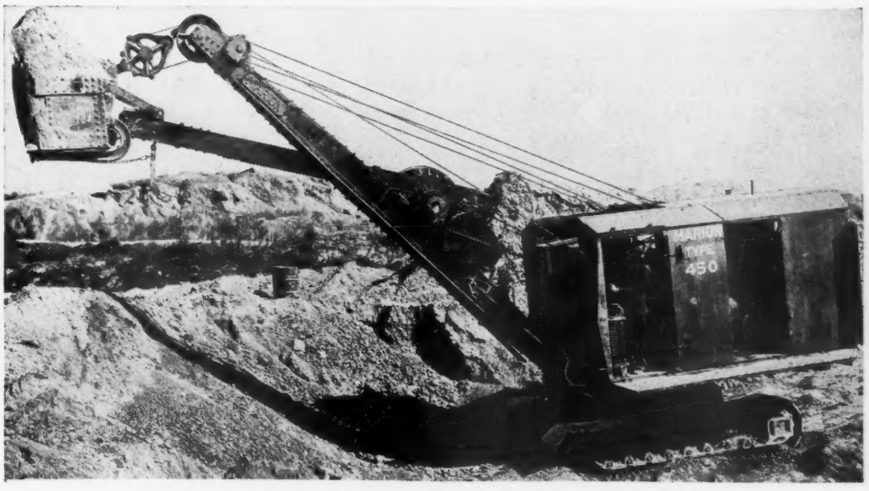


Fig. 6. A new 1 1/4-yd. Diesel-engine-electric shovel

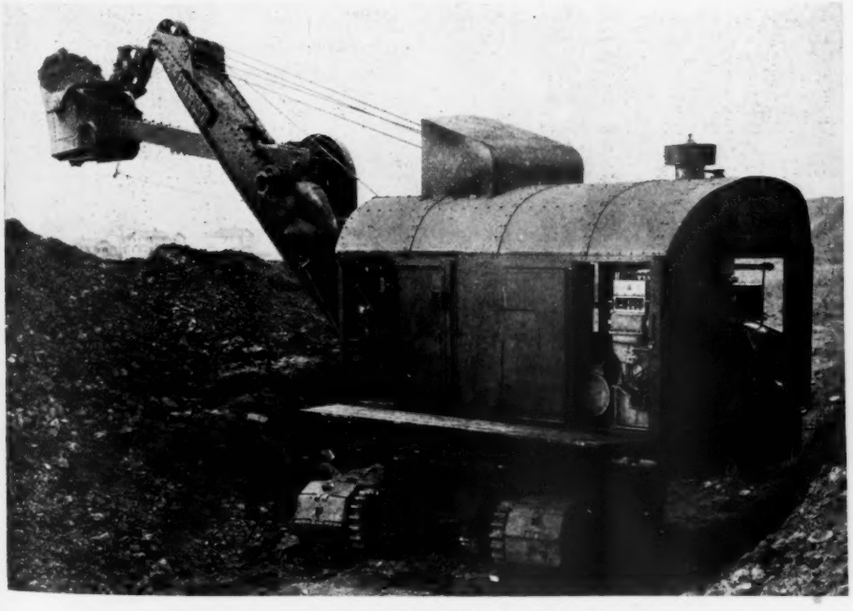


Fig. 7. A new 2-yd. Diesel-engine-electric shovel

About mid-year the Marion Steam Shovel Co., Marion, Ohio, announced the "largest" shovel ever (Type 5480, 12-yd.) described in ROCK PRODUCTS, June 23. Six of these are now in service. But this is not the limit in size, it seems, for the company is now assembling a Type 5600 shovel, which weighs 1550 tons, compared with 850 tons for Type 5480, has a 120-ft. boom, compared to the latter's 90-ft., and an 83-ft. dipper handle, compared with 60-ft., and a 15-yd. dipper, compared with 12-yd. It will be used for stripping. The accompanying drawing, Fig. 5, shows the relative dimensions of this latest 5600 giant compared with the June record breaker 5480, and a standard 1¼-yd revolving shovel.

The Marion company also developed two Diesel-engine powered, electric-driven shovels, a 2-yd. and a 1¼-yd. The Diesel engine in the 2-yd. shovel is a Winton 6-cylinder, 4-cycle, airless injection engine, developing 150 hp. at 750 r.p.m.,

direct-connected to a 50-kw. (continuous) "drooping voltage" generator, which supplies current to a 3-mill type, roller-bearing, fan-ventilated, mica-insulated, d.-c. motor. The Diesel in the 1¼-yd. shovel is a Buda, M.A.N., 4-cylinder, 4-cycle, airless injection engine developing 92 hp. at 1000 r.p.m. It is connected to a 25-kw. "drooping voltage" generator, of the same type as in the larger shovel. The motor is also of the same type. The 1¼-yd. shovel is illustrated in Fig. 6 and the 2-yd. in Fig. 7.

The Bucyrus-Erie Co., Milwaukee, Wis., announced in June a new ¾-yd. gasoline shovel and crane (Rock Products, June 9). Early in the year this company also placed in operation on coal mine stripping a "largest" revolving shovel, weighing 894 tons, with a 12-yd. dipper, known as Type 750-B. This shovel is illustrated in Figs. 8-11 inclusive. It has the same speed as the fastest 8-yd. stripping shovels, giving a 50% increase in production with no increase in labor expense. Special features of this shovel are: (1) Two separate hoists; (2) twin swing machinery units; (3) new type of support for the boom; (4) a two-part cast dipper—built without a rivet. All digging motions are governed by three small easily working electric controllers, two worked by hand, one with the foot. Two motors, four gears, a drum, a safety friction, and two holding brakes comprise the main machinery. Two 250-hp. motors drive through the first herringbone gear reduction, which is enclosed and runs in oil. Ward-Leonard control is used. As on the main machinery so on the crowd there are only two gear reductions driven by a 100-hp. motor.

While a few quarries have already

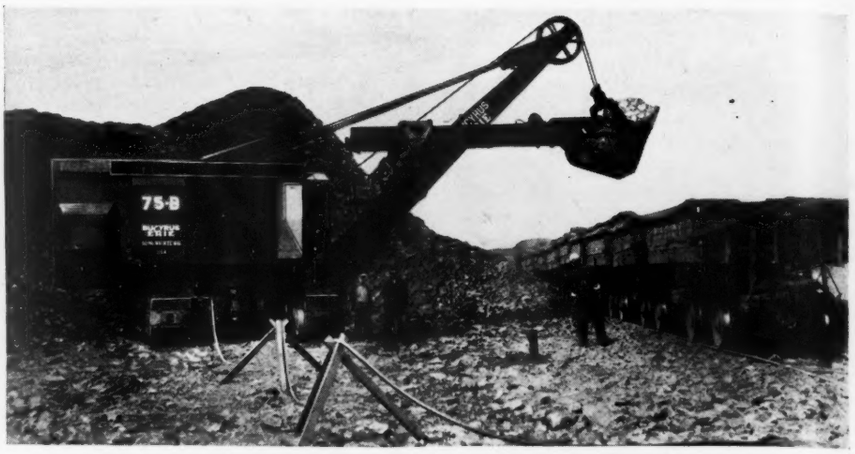


Fig. 12. New 2½-yd. electric shovel specially designed for quarry work

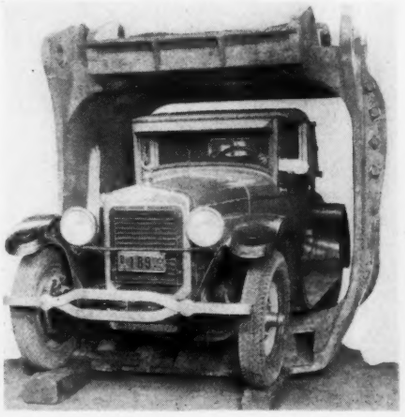


Fig. 10. The 12-yd. shovel dipper

Fig. 8. An 894-ton, 12-yd. stripping shovel

Fig. 9. Crawlers and carriage of 12-yd. electrically operated shovel

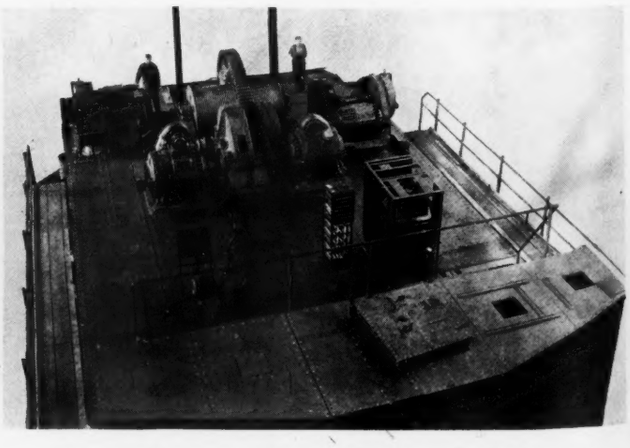


Fig. 11. Motors and drums on operating platform of 12-yd. shovel

adopted very large revolving shovels for stripping, or loading, the more popular sizes are from 1- to 5-yd. In this field the Bucyrus-Erie Co. has recently announced a 1¼-yd. electric convertible shovel (41-B) and a 2½-yd. (75-B) machine, following closely in design the 3-yd. and 4-yd. shovels, especially built for mining and quarrying. It is also convertible into a drag-line. The 75-B, it is emphasized, is not a 2-yd. shovel equipped with a 2½-yd. dipper, but built throughout to handle the 2½-yd. dipper. As in the 3- and 4-yd. shovels the control used is the Ward-Leonard electric. An important feature is the elimination of the clutch and brake in the hoist machinery. Regenerative lowering of the dipper on the motor, it is claimed, reduces the net power consumption. This shovel is illustrated in Fig. 12.

The Harnischfeger Corp., Milwaukee, Wis., brought out two additional attachments for its ½-yd. shovel, early in the year (Rock Products, February 18); a short time later a new type of dragline bucket (½- to 1¼-yd. (Rock Products, March 17). This company has also just announced a new "P & H" 3½-yd. excavator, known as Model 900 (Figs. 13 and 14). The power is a 6-cylinder Diesel engine. Roller bearings are used throughout the main machinery. The four sets of swiveled, conical steel swing rollers, which carry the weight of the revolving structure, also are provided with anti-friction roller bearings. The over-all width is 14½ ft., length 25 ft. It is convertible to dragline, crane, etc.

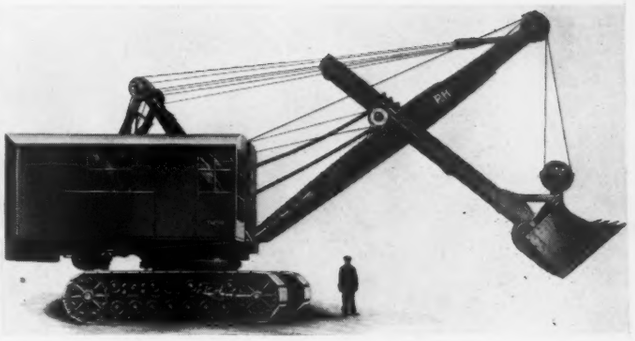


Fig. 13. New Diesel-engine-powered 3 1/2-yd. excavator

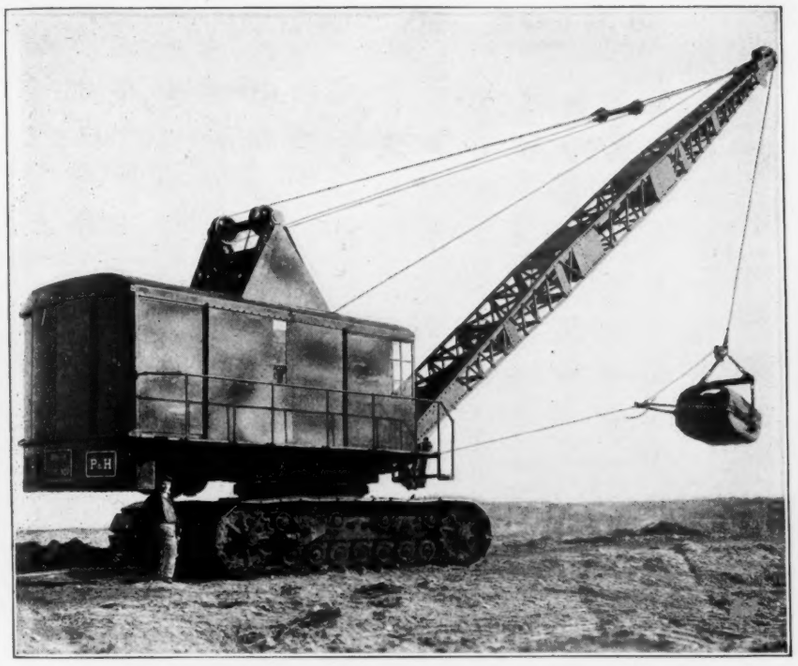


Fig. 14. Same machine shown in Fig. 13, equipped as dragline

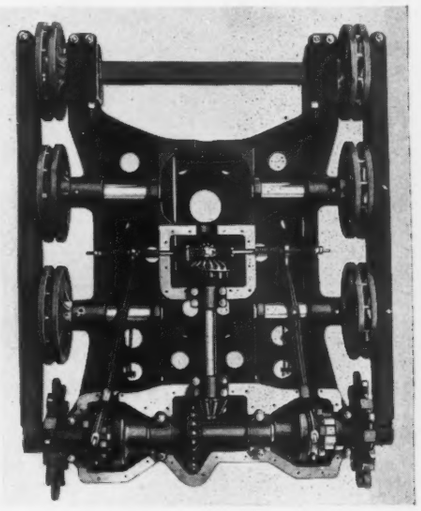


Fig. 16. Car body construction of a new crane

The Osgood Co., Marion, Ohio, in the early spring placed a new line of small gasoline shovels on the market under the trade name "Conquerer" (Rock Products, April 28). Recently this company has

Fig. 15. A new 1 1/2- or 1 1/4-yd. gasoline convertible shovel

Fig. 17. A tractor shovel used at small lime-plant quarries

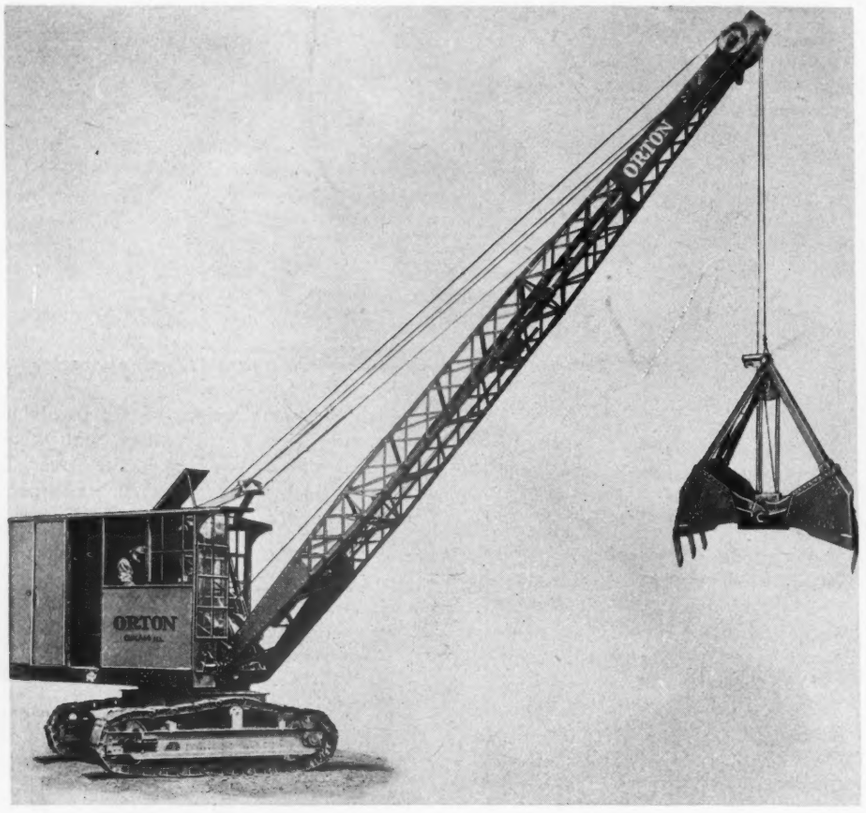


Fig. 18. Another new convertible equipped as a 6-ton crane

added to its line a somewhat larger gasoline shovel (1½- or 1¼-yd) of similar design, known as the "Victor" ,illustrated in Fig. 15). Like all the modern excavators it is convertible to dragline, crane or back hoe.

During the year the Manitowoc Engineering Works took over the manufacture of the Moore "Speedcrane," redesigned and improved it. Particular attention was paid to the design of the car-body, which is shown in Fig. 16. A single, high-manganese steel casting carries all of the axles, adjusting screws, center pin and roller path gears, and houses the travel shafts, gears and clutches. A Hercules motor, developing 92 hp. at 900 r.p.m., is used for power. By means of a foot accelerator the engine may be speeded up to 1200 r.p.m., giving 108 hp. Power transmission is through a "twin disc" clutch housed and running on Timken roller bearings.

The Trackson Co., Milwaukee, Wis., introduced a crawler shovel of special design, showing in Fig. 17, which has found a use in small lime-plant quarries.

A new model "A" convertible ⅝-yd shovel, crane, dragline has recently been announced by the Orton Crane and Shovel Co. (Fig. 18). Among the features claimed are the use of alloy steel for all power shafts and gears, and the extension of the cab so that the work can be seen from both sides of the operator's position. Self-cleaning, flexible crawling treads of the spring type furnish the means of traction, but road wheels are optional. This machine can be furnished with shovel, crane, dragline, ditcher or skimmer attachments. As a crane it has a lifting capacity of 6 tons on a 12-ft. radius.

Fig. 19. A new type of excavator for stripping, etc.

A contribution to the excavator industry by the Barber-Greene Co., Aurora, Ill., was a new overload release sprocket for its line of bucket loaders (Rock Products, November 24). This company's latest development is a new excavator (Fig. 19) which will probably find an application in stripping operations. It is claimed to be the only excavating machine which, in excavating the material, prepares it for other uses; it is said to cut from 1 in. to 7 ft. in one operation, at a capacity of from 1 to 3 cu. yd. per min.

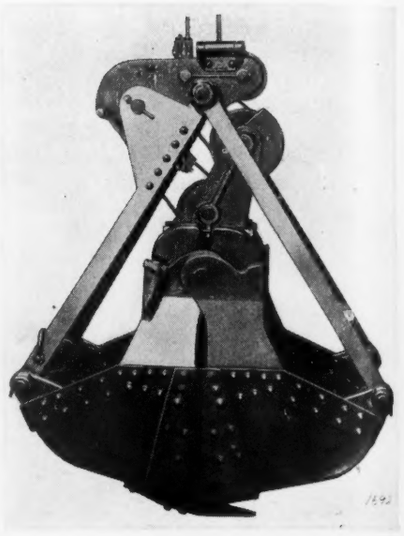


Fig. 20. New strong-biting clamshell bucket

Fig. 21. Improved block for cableway excavators

In the clam-shell bucket field the G. H. Williams Co., Erie, Penn., announces a new general-service ½-yd. bucket, especially designed for light cranes (Fig. 20).

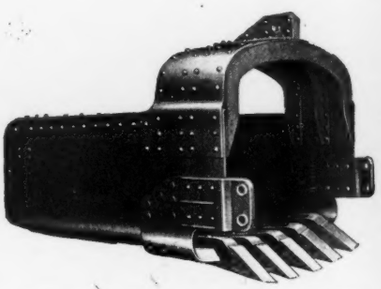


Fig. 22. New bucket for various kinds of digging

A special feature is the combined lever and block-and-tackle, to give heavy leverage in digging. The bucket is equipped with high-carbon steel teeth. It is supplied with either roller or plain bearings.

Sauerman Bros., Inc., Chicago, Ill., pioneer manufacturers of slackline, cableway excavators, produced during the year a new improved "Durolite" block (Fig 21) and a new type excavating bucket (Fig. 22), known as the "Universal"—so named because it is adaptable to so many different digging operations. It may be furnished with teeth, as illustrated, for hard digging. It has an extra heavy manganese-steel lip and a reinforced heavy bale. The bottom is protected against wear by runner shoes.

A newcomer in the cableway excavator field is the Street Bros. Machine Works, Chattanooga, Tenn. This company's new 2½-yd., back-dump bucket is illustrated in Fig. 23, and a new gravel plant equipped entirely with this company's cableway excavator, bucket and hoist is shown in Fig. 24. The hoist made by this company is described elsewhere in this issue. Among the special features are fabricated steel masts, and the design of the bucket, which is furnished in sizes ranging from ½- to 3-yd. By changing the swivel connection on the bale and adjusting the chains that support the bucket, the dumping angle may be regulated.

Fig. 23. New back-dump slackline excavator bucket

Fig. 24. Recent Southern sand and gravel plant equipped with bucket shown in Fig. 23

Transportation Equipment

THE MOST notable achievements in the transportation field in 1928 seem to have been in the direction of motor trucks, tractors and trailers for exceptionally heavy service. Early in the year a new 3½- to 5-ton Mack truck was announced (Rock Products, February 4). The Caterpillar Tractor Co., San Leandro, Calif., and Peoria, Ill., placed on the market a new 20-hp. industrial tractor for general utility plant use (Rock Products, February 18.) Many examples of the use of caterpillar tractors at rock-products plants have been published during the year. In March the General Electric Co., Schenectady, N. Y., became interested in the motor truck field, announcing a new type of gas-electric truck and trailer (Rock Products, March 31). The Biehl Iron Works, Inc., Reading Penn., produced a new creeper, or crawler-tread dump wagon (Rock Products, August 4). The Commercial Shearing and Stamping Co., Youngstown, Ohio, announced three-way dump bodies for motor trucks (Rock Products, August 18). The Ditwiler Manufacturing Co., Galion, Ohio, announced a new power dump body for trucks (Rock Products, September 29). The Austin Manufacturing Co., Chicago, Ill., has just announced a third innovation in Western 5-yd. crawler-tread wagons, in line with its 7- and 10-yd. wagons.

Fig. 26. Improved small gasoline locomotives

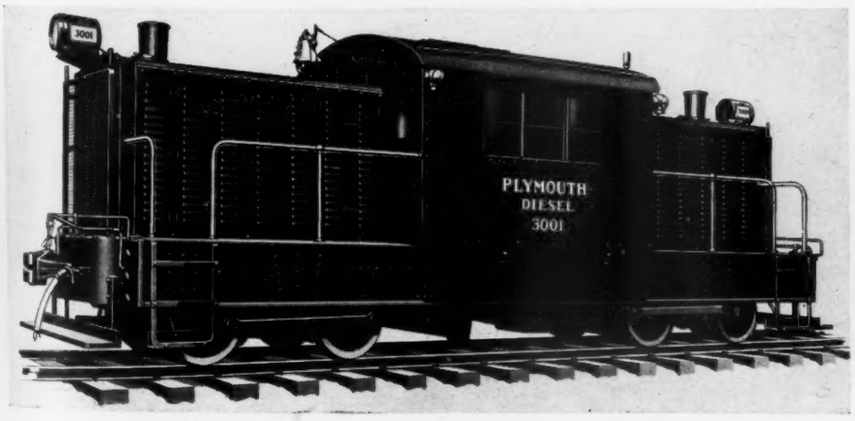


Fig. 25. A 60-ton, direct-geared Diesel-engine-powered locomotive

As usual gasoline locomotive manufacturers made many improvements. The H. K. Porter Co., Pittsburgh, Penn., pioneer builders of steam locomotives, placed on the market a new gasoline locomotive (Rock Products, March 31). The largest industrial locomotive yet made is claimed by the Fate-Root-Heath Co., Plymouth, Ohio, (the Plymouth Locomotive Works)—a 60-ton direct-gear-drive, Diesel-engine locomotive, illustrated in Fig. 25. The power unit is an 8-cylinder, 8½-in. bore x 12-in. stroke Win-

Fig. 27. A 30-yd. air-dump car with special features

ton motor, developing 400 hp. at 700 r.p.m. The locomotive is 37 ft. long overall. It is built for standard speeds 3 to 24 mi. per. hr. It has standard Westinghouse air brakes, and is equipped and is rugged and strong enough for any railway service. With this new addition Diesel-engine, Plymouth locomotives are available from 12 to 60 tons.

The Brookville, Locomotive Co., Brookville, Penn., which announced a new 4-ton gasoline locomotive (Rock Products, May 26) has very much improved the appearance of its line, as illustrated in Fig. 26.

The Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., produced the first light weight (85 tons) oil electric switcher locomotive. It is about 600 hp., and

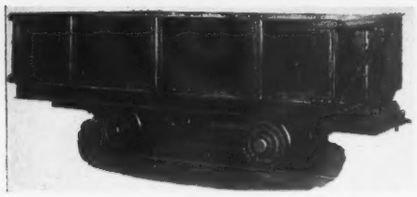


Fig. 28. Automatic side-dump car

while probably too big for ordinary rock products service, it may be used for standard gage switching service at some plants.

In the industrial car industry the Koppel Industrial Car and Equipment Co., Koppel, Penn., announced a new air-dump car (Fig. 27). This car is of all-steel construction, of 30 yd. capacity and has automatic, rolling trunnions. A special feature of its construction is that the entire weight of the car body and lading is carried in stable equilibrium directly on the center sills without the use of trunnions. This is accomplished by rolling diaphragms, one located at each cross bearer supporting the air cylinders. The dumping operation is controlled by three valves; a manually controlled indicator valve, an operating valve, and a control valve that allows cars to be dumped in train-loads. The indicator valve, which indicates the side on which the car is to be dumped, is manually set by a rod passing across the car at the ends of which are index plates. This valve can be set to dump on either side or at neutral. The operating valve is located at one end of the car, and when operated admits air to the set of cylinders on the side for which the indicator valve is set, dumping the car. The operating valve handle can be locked in a closed position when necessary. The control valve allows the cars to be operated in trains from the operating valve of any car selected in the train, and by proper setting of the indicator valve any car or cars in the train can be controlled as desired.

The Atlas Car and Manufacturing Co., Cleveland, Ohio, announces a side-dump car of unusual design (Figs. 28, 29). The car has a capacity from 5 to 7 tons It is of the automatic dump type, with the dumping controlled by a section of separate inclined track which is movable, which can be placed at a predetermined point to dump the car automatically. This particular is designed to dump from a trestle to storage piles. A roller on the far side of the car engages the inclined rail. The discharge gates are arranged to assist in counter-balancing the weight of the hopper as it is dumped, thus adding to the stability of the empty car in dumping position, particularly desirable when operating from a trestle, as in this case. The car is mounted on 16-in. chilled cast-iron wheels with Timken roller bearings The entire car is steel. It was built for the Madison Sand and Gravel Co., Solsville, N. Y.

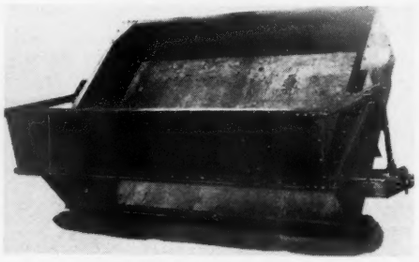


Fig. 29. In dumping position

Track accessories announced during the year include a narrow-gage track shifter by the Nordberg Manufacturing Co., Milwaukee, Wis., (Rock Products, April 28) and a flexible rail for shifting track directions by the Illinois Power Shovel Co., Nashville, Ill. (Rock Products, December 8). The Nordberg company has manufactured a standard-gage track shifter for several years.

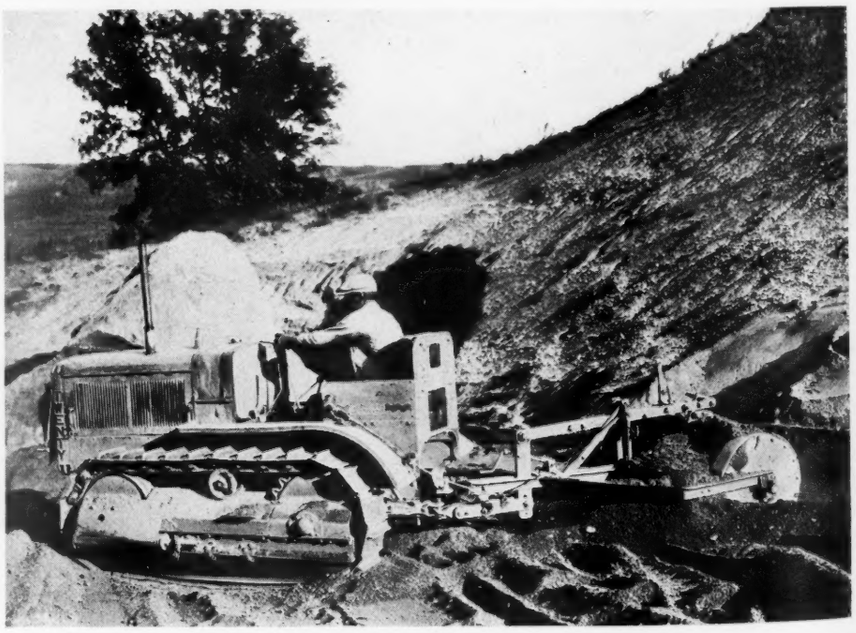


Fig. 30. One of many uses for caterpillar tractors

Crushers and Pulverizers

SEVERAL manufacturers have made improvements in jaw crushers. The Iowa Manufacturing Co., Cedar Rapids, Iowa, added a new 14x36-in. jaw crusher to its products (ROCK PRODUCTS, January 21). The Good Roads Machinery Co., Philadelphia, Penn., manufacturers of the "Champion" line, brought out a new jaw crusher with four Timken and two SKF roller bearings, especially designed for fine reduction (ROCK PRODUCTS, March 17). At present this crusher is made only with a jaw opening of 10x30 in., but two other sizes will be added. The Wheeling Mold and Foundry Co., Wheeling, W. Va., began marketing a 9x36-in. jaw crusher with roller bearings (ROCK PRODUCTS, June 23).

Fig. 31. New safety device for jaw crusher

It was learned in one installation of these crushers (at the plant of the Bankers Sand and Gravel Co., Middletown, Ohio) that it was not necessary to mount this crusher on a concrete foundation at or near ground level, that its freedom from vibration permitted its being placed on top of the bin structure, crushing the screen oversize without the customary re-elevating after crushing.

The Traylor Engineering and Manufacturing Co., Allentown, Penn., introduced a new safety device for its line of "Bulldog" jaw crushers. This device (Fig. 31) consists primarily of a punch actuated by the eccentric or pitman shaft of the crusher, and a punching bar, through which the punch is driven when excessive strains are developed. The punch is held in position by a plunger working in the body of the saddle of the pitman, and in contact with a roller attached to the back end of the front toggle. A die of hardened steel is placed below the punching bar, which is of ordinary bar steel, and which is sufficiently strong to take all of the crushing strains in normal operation. Extraordinary pressure from a packed crusher, or a piece of tramp iron, will drive the punch through the punching bar. The slug that is punched out falls out of the pitman rocker and the toggles drop. Stops prevent the toggles from dropping below a limited distance. Crushing stops immediately because the clearance between the plunger and the plunger roller is greater than the total vertical stroke of the pitman. The device is patented and can be adapted to any make of jaw crusher.

The Traylor company also added a new 15-in. finishing crusher to its line of "Bulldog" gyratory crushers. This series now includes 4½-in., 6-, 10-, 15- and 20-in. sizes.

A new hammermill crusher especially designed for reducing large sizes of wet or sticky limestone to 1¼-in. ball-mill feed in one operation was developed during the year by the Williams Patent Crusher and Pulverizer Co., St. Louis, Mo. This hammermill is known as "a pusher feeder non-clog crusher" (Figs. 32 and 33). Two installations of these during the year are at the plants of the Trinity Portland Cement Co., Fort Worth, Texas, and the Ash Grove Lime and Portland Cement Co., Chanute, Kan. The city of Chicago is installing one to crush wet limestone taken from a water-works intake under Lake Michigan.

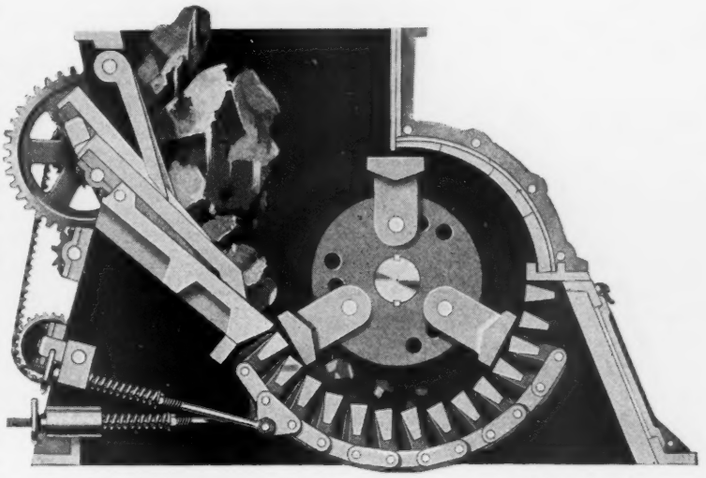


Fig. 32. A hammer mill designed for wet or sticky limestone

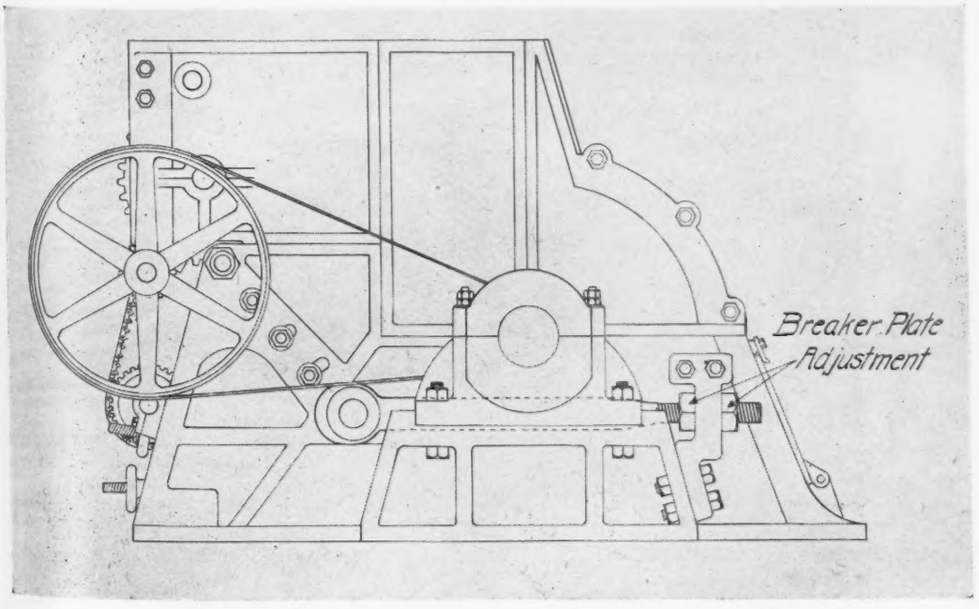


Fig. 33. Details of the hammer mill shown in Fig. 32

The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., developed and built a *standard* 60-in. Superior McCully gyratory crusher. We emphasize the *standard* because but a year or two ago a 60-in. gyratory was a curiosity. The new standard 60-in. is considerably lighter in design than the special 60-in. Allis-Chalmers made in 1926 for a South American copper mine. Moreover, this 60-in. crusher is going into a quarry operation in this country—one of the Solvay Process Co.'s.

The original standard Allis-Chalmers Newhouse reduction crusher has been superseded by the Newhouse style "B" machine, which has improved bearings and a bottom plate removable without dropping the eccentric. The entire line of standard McCully crushers has been im-

proved by the addition of a dust seal. Crusher parts have been improved by being made of special high test iron having a Brinnell hardness of 225 as compared with a Brinnel of 150 for ordinary cast iron.

In the roll-crusher field the McLanahan-Stone Machine Co., Hollidaysburg, Penn., announces that it is now making an inserted tooth roll for its crushers. These were placed on the market about a year ago and to date 60 machines so equipped are in use. The only operation necessary to renew the teeth is to slip out a wedge, insert a new tooth, and drive the wedge into position. A keeper on the back of the tooth, which is turned over the wedge, holds it in position, so it can not work out. In removing the tooth this keeper is cut off with a chisel, so as to give room for the removal of the wedge.

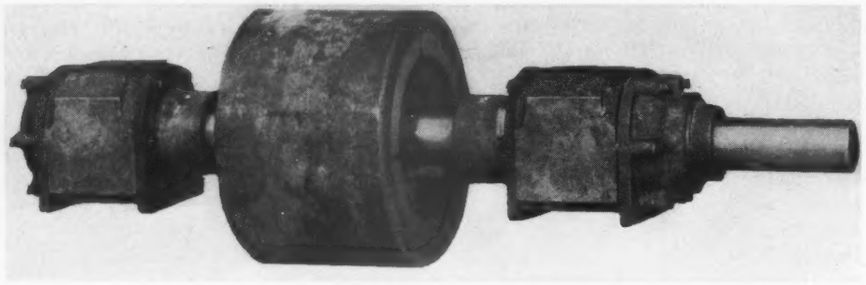


Fig. 34. A new type of crushing rolls using railway type roller bearings

The Sturtevant Mill Co., Boston, Mass., has developed an improved type of crushing rolls (Fig. 34). The object sought was a pair of crushing rolls that would maintain a uniform space between the rolls, so necessary for uniformity in crushing, especially to the smaller meshes and so difficult of attainment when using rolls on hard or abrasive materials, for a variation in the space between the rolls may be caused either by uneven wear of the roll shells or from the wearing of the shafts and the babbitt journal, or a combination of all three causes.

Babbitted journals are usually provided with means to prevent the entrance of dust and must be designed to permit of wear of the babbitt, without causing a rubbing or binding action. Hence this construction does not offer an ideal dust or wear preventive design. Another cause of journal wear is the use of oil or grease as a lubricant, which with babbitted bearings has to be frequently renewed. Carelessness in filling the grease cups or oil container permits dust to enter, which later causes bearing trouble.

The Sturtevant Mill Co. has designed crushing rolls to overcome these difficulties by use of Hyatt railway type roller bearings, for it was not until the development of large diameter, heavy load railway type bearings, of the anti-friction type, such as ball or roller, that anti-friction bearings could be applied to crushing rolls satisfactorily.

The illustration, Fig. 34, shows the roll shaft with hearts and roll shell, and the two shaft mountings. The housings are provided with labyrinth type dust collars, which have proven effective in preventing dust and grit from reaching the bearings. As there is no wear on an anti-friction bearing, very close clearances on these collars can be provided.

In order to provide for the thrust caused by unequal feeding across the face of the roll shells, totally enclosed double ball bearings are used on the short end of the shafts.

Aside from the saving in power other advantages claimed for the new crushing rolls are elimination of wear on the journals or shafts and hence time saving and uniform crushing. The Alemite system of lubrication is employed.

Another new double-roll crusher is being developed by the Butterworth and Lowe Division of the Oliver Machinery Co., Grand Rapids, Mich., as a result of a special study of slag crushing.

During the year the first installation in this country of the Polysius Corp.'s "Solo" hammermill crusher was made at the plant of the Keystone Portland Cement Co.

These grate bars, made of manganese steel, are curved concentric with the axis of the crusher shaft. They are so spaced, with ample clearance, to permit the hammers to swing between them and thus extending the breaking zone a sufficient distance into the hopper to permit of preliminary crushing in the hopper.

The cage is made sectional and consists of triangular bars of specially heat treated steel mounted in heavy removable steel frames. The spacing of the bars is maintained by wedges, which can be adjusted to increase or decrease the openings between the bars, and thus vary the size of the discharged crushed rock. The cage frames may be adjusted so that the bars are either concentric or eccentric with the axis of the crusher shaft. This latitude of adjustment is possible through the method of supporting the cage. The lower end of the cage is hinged on a heavy steel bar which traverses the crusher frame from side to side directly under the breaker plate. The upper end of the cage is flanged and is provided with bolts which pass through a horizontal offset on the center line of the crusher frame. When these flange bolts are dropped, the cage swings downward on its supporting bar and the distance between the hammers and the cage bars is increased. When the flange bolts are pulled up, the cage moves up on its supporting bar as an axis and the distance between the hammers and the cage bars is decreased, giving considerable range in capacity and fineness of output.

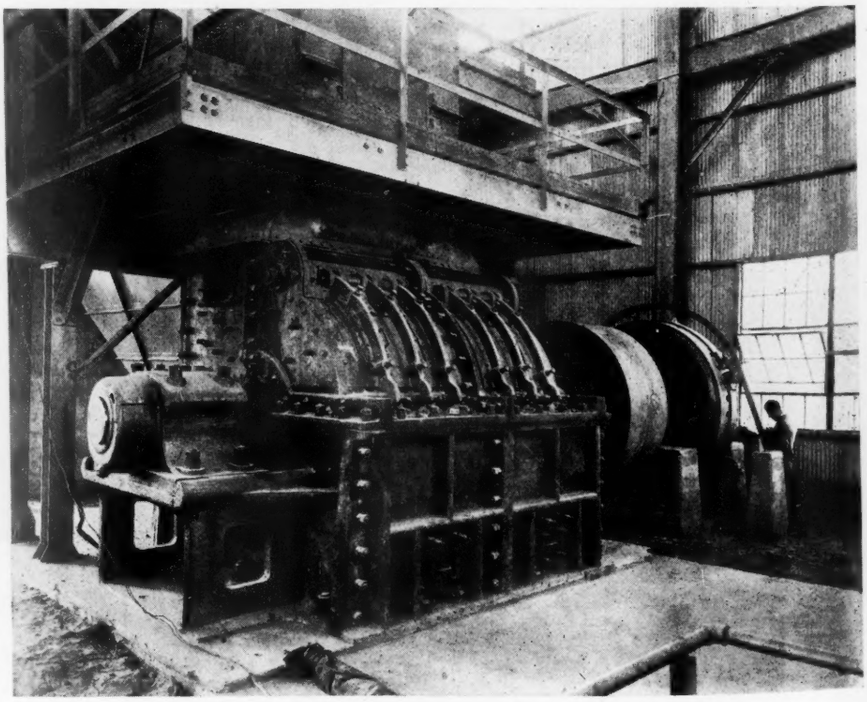


Fig. 34-A. New European type of hammer-mill crusher

Screens, Washers and Classifiers

ONE marked tendency in the crushed stone and gravel industries during the year has been the popularity of vibrating screens over cylindrical screens. Saving in headroom and floor area and more accurate sizing are doubtless among the reasons for preferring vibrating screens to older types for sizing, particularly in the case of the smaller sizes of material. The vibrating screen manufacturers are constantly increasing in numbers, the year 1928 having seen several new ones.

Among the rock products equipment manufacturers to announce a new vibrating screen, the most recent is the Good Roads Machinery Co., Kennett Square, Penn. The "Good Roads" vibrating screen, which has not yet been formally introduced to the industry, is said to have several novel and unique features. Basically, its design is of the unbalanced weight type and the entire screen frame is vibrated. For changing the strength or scope of vibrations, instead of adding or removing weights on the unbalanced vibrating unit, this new screen is adjustable between minimum and maximum units by turning of a special adjusting nut at each end of the shaft. This greatly facilitates adjustment and permits time saving. In place of springs the new "Good Roads" screen is supported by rubber balls, which, being resilient, at the same time are said to impart a thumping action to the screen, thus increasing screening efficiency. At each corner of the screen frame is a rubber ball support, consisting of a tubular housing in which are two rubber balls, the screen frame-supporting bracket being imposed between them. When the screen shaft is running at proper speed, the entire screen frame vibrates on these balls. A hopper equipped with a vibrating door arranged to regulate the feed is a part of the unit. This screen is to be supplied in single-, double or triple-deck types.

The Sturtevant Mill Co., whose new "Moto-Vibro" was announced in ROCK PRODUCTS annual review number a year ago, has perfected this type of "skeleton" screen. Because of its lightness, it is now made in sizes containing 40 sq. ft., vibrated at the rate of 1800 impulses per minute with a shaft speed of 300 r.p.m., by a simple toggle mechanism which lifts and lowers the vibrating head. One end of this toggle is pivoted and the other end incorporates a roller mounted in roller bearings and held in contact with a six-sided shaft, thus producing six vibratory impulses to each revolution of the shaft.

The Smith Engineering Works, Milwaukee, Wis., is just announcing a new "Telesmith" balanced vibrator (Fig. 40), which is a double-deck screen with a steel frame. Power is delivered to a heavy shaft centrally located, journaled in roller bearings. The two decks are bracketed to this shaft, being actuated by opposed eccentrics, running in ball bearings, completely housed By reason of the opposed eccentrics the upper screen surface rises as the lower goes down, and vice versa, both operating at high speeds. The screen traps are supported at both ends by compression springs in automatic balance. A cam arm at the head of the screen makes it possible to change the pitch of the screen. The screen cloth is changed by loosening a series of bolts. Rubber washers are used to prevent loosening of the nuts, and the edges of the wire are protected by rubber shields.

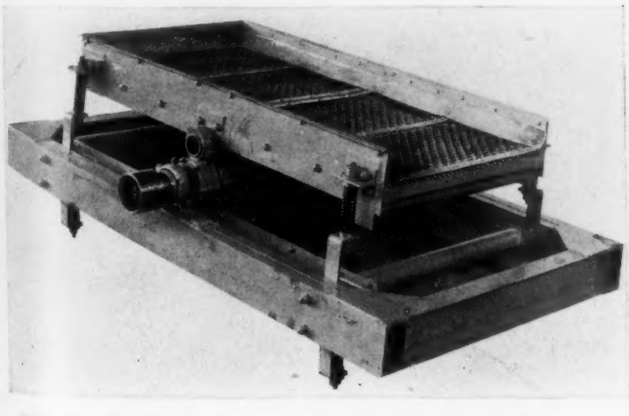


Fig. 40. Double-deck screen of the balanced vibrator type

A new three-deck, heavy duty "Rotex" screen made by the Orville Simpson Co., Cincinnati, Ohio, was described in ROCK PRODUCTS, May 26. The latest development of this company is the incorporation of a double compensating balance wheel system in its line of "Rotex" screens. The new model, known as "Rotex No. 6-R" (Fig. 41) has a single screen surface 3x7 ft. The screen cloth is held in place by tension screws, which stretch it taut lengthways as well as sideways. It is claimed to be particularly suitable for screening from ¾in. down to the finest sizes, and is adaptable to wet screening and washing, or for dewatering. The drive head which imparts to the screen frame a 2¼-in. circular motion contains two oppositely rotating balance wheels, which are designed to cancel the recoil forces, so that the screen may be placed high in building structures without imparting vibration to the structure The vertical crank shaft is actuated through hardened and ground spiral bevel gears running in an oil bath. The shaft are mounted with one Timken roller bearing and six SKF ball bearings with extra precaution to keep out sand and water. As in all "Rotex" screens, solid rubber balls are confined in pockets beneath the screen cloth so that the gyratory motion of the scren frame throws them against the under surface of the screen to dislodge particles caught in the meshes.

The Deister Concentrator Co., Fort Wayne, Ind., states tha it has changed the method of suspending its "Leahy" screen jacket (Fig. 42). In combination with slide rails, which are attached to the side members of the main screen frame, the construction of the vibrating beam and upper mounting bars has been improved so that these parts work in conjunction with the slide rails. Also a change has been made in the tension bolts which allows a quick detachment of these parts when necessary to change a screen cloth. Loosening the connection at the yoke under the vibrator and breaking the connection at the upper tension bolts, the screen jack assembly settles down to the slide rails, which support the weight and allow this assembly to slide from place.

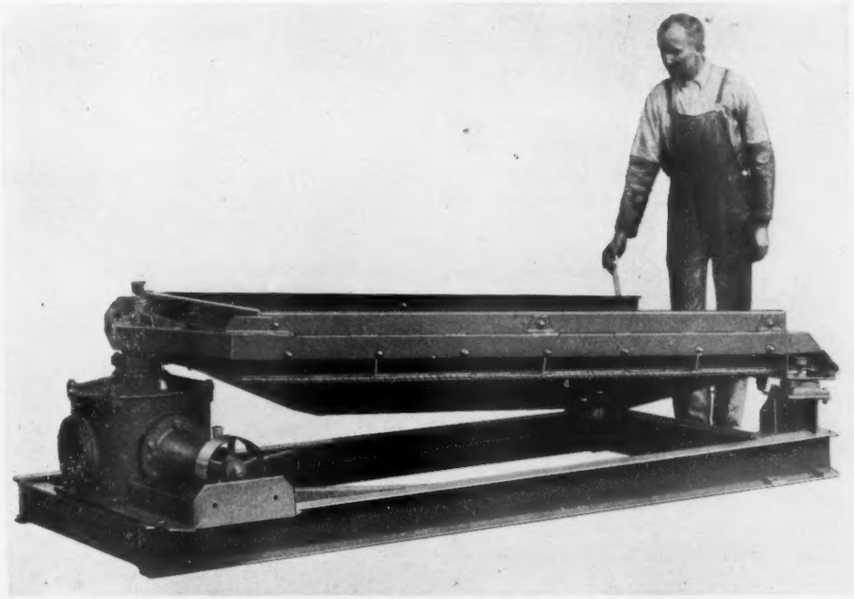


Fig. 41. Rotating-head type screen of new design

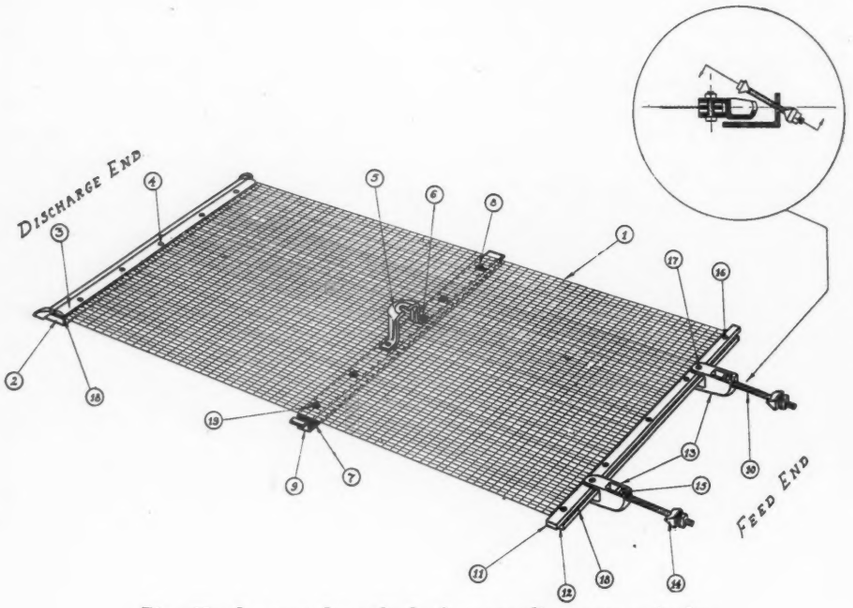


Fig. 42. Improved method of suspending screen jacket

A replacement jacket is assembled by reversing the operations.

The Stephens-Adamson Co., Aurora, Ill., announces that it will have a new vibrating screen on the market in a few weeks The details are not available at this writing, but it is said to be the result of several years' tests and will combine simplicity with an efficient screening principle. The ease of replacing screening surfaces is a special feature. This company also incorporated several improvements during the year in its live-roll grizzly. A geared oil pump (Figs. 43 and 44) now provides a positive circulation of oil over the totally enclosed roller-drive mechanism. Turned grooves of an improved shape are claimed to have resulted in rollers which have smoother action and increased screening efficiency. With the new rollers products down to 1¼-in. can be separated.

The Traylor Vibrator Co., Denver, Colo., has improved its electrically vibrated "Screen Supreme" by equipping it with a steel screening deck, replacing the wood maple structure previously used, giving the machine greater flexibility for meeting special problems and unusual conditions. This steel construction is said to be the result of much experimental work during the past two years. The two-surface screen has been arranged with staggered or offset decks, the lower being set in the line of flow of the feed so that none of its area is lost The new steel screen decks have been especially designed for rapid cloth change. The cloth itself has angles bolted at its two ends, and can be removed from the screen by loosening one tie rod on each side of the sash or frame

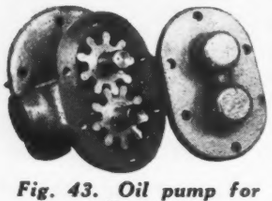


Fig. 43. Oil pump for roll grizzly

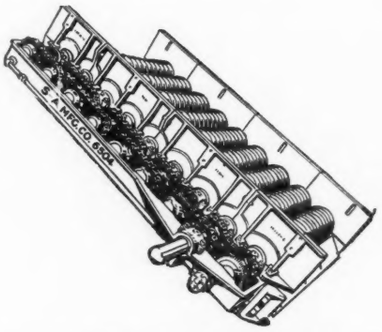


Fig. 44. Roll grizzly with housing removed, showing location of oil pump

and unhooking the angles from vibrating deck. The two ends of the cloth are interchangeable, allowing it to be reversed, end for end. The Deister Machine Co., Fort Wayne, Ind., has brought out an improved "Plat-O" vibrating screen, of all-steel construction, welded. The vibrating mechanism is of the unbalanced pulley type with means for adjusting the magnitude of the vibrations. Vibration absorbers are provided to take up substantially all the vibrations of the screen box, it is claimed, preventing them being transmitted to the building. This screen is designed to have a horizontal, differential conveying movement as well as a vertical vibratory action, in order to permit the screen being installed at very flat screening angles (10 to 15 deg. from the horizontal).

Another new screen, about to make its initial bow to the industry, is being made by the Productive Equipment Co., Chicago—the "Jigger." The design of this screen involves a positive eccentric action and in addition a variable eccentricity from a neutral setting where the eccentricity is zero to a maximum setting where the eccentric throw is ⅜ in. An intermediate adjustment of eccentricity may be made by use of an eccentric sleeve on an eccentric shaft. By changing the position of the sleeve with respect to the shaft eccentricity a change in the accumulative eccentricity takes place. A tilting method is employed for changing the inclination of the screen cloth, which is accomplished by mounting the vibrating mechanism in a circular cradle and employing hand star-wheels to keep the screen assembly rigid in the cradle shell for any particular degree of inclination. A rapid method of screen cloth change is another claim. Ordinary screen cloth of any mesh or wire diameter is inserted between angle iron brackets at the side sheets of the screen assembly and by means of hand star-wheels located outside the screen side sheets the screen cloth is both clamped in place and given the necessary tension. L. E. Soldan is the designer of this screen.

In the classifier field probably the most important development was the placing of the Shaw classifier on the market by the Link-Belt Co., Chicago (Rock Products, October 13).

The Smith Engineering Works, Milwaukee, Wis., brought out a screw "rewasher," illustrated in Fig. 45, especially designed for final cleaning of sand or stone.

The Eagle Iron Works, Des Moines, Ia., has improved its standard screw washer by incorporating a Goodrich cutless rubber bearing at the low end, and by moving the roller thrust bearing from the lower end to the upper end, where it operates above the water line, preventing grit from entering.

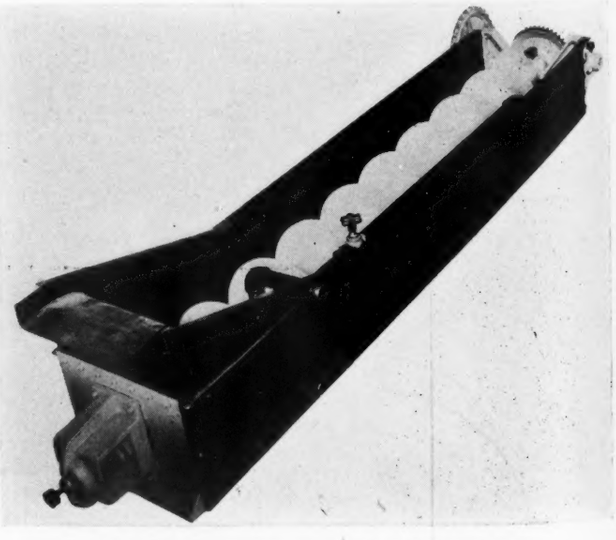


Fig. 45. Rewasher screw for dry product

Conveyors

THE first new development of the year in conveyors, according to our files, was a light-weight portable belt conveyor by the Link-Belt Co., Chicago, known as the "Jax" (ROCK PRODUCTS, April 28).

The Traylor Vibrator Co., Denver, Colo., manufacturers of a well known electrically vibrated screen, announced a conveyor operacting on the same principle (ROCK PRODUCTS, June 9).

The Fairfield Engineering Co., Marion, Ohio, brought out a new belt conveyor idler with Timken roller bearings (ROCK PRODUCTS, September 29).

The Stephens-Adamson Manufacturing Co., Aurora, Ill., has designed a new end casting for its line of "Sacon" ball-bearing,

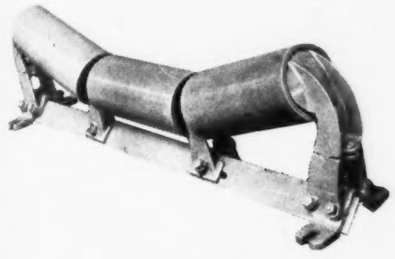


Fig. 35. New bracket on end casting for belt conveyor

belt conveyor carrier (Fig. 35). This new outer support bracket fits close to the pulley end and prevents any chance of lumps or stones wedging between the pulley and its bracket. This new design is also claimed to furnish additional protection for the end bearings, which ordinarily are likely to be exposed to moisture, dust and grit. These "Sacon" carriers are made with either ball or roller bearings, mounted in dust-tight, self-aligning housings, and these improved end stands are now standard for all sizes from 24- to 48-in. belts.

The Stearns Conveyor Co., Cleveland, Ohio (owned by the Chain Belt Co., Milwaukee, Wis.), has just announced the addition of two new types of anti-friction idlers. The full line of this company now comprises four different types of idlers, each developed for a particular conveying service: A chilled face cast-iron idler for handling abrasive materials; a pressed-steel idler, relatively light in weight; a new "Rex-Stearns" (Figs. 36 and 37) tubular steel idler for handling materials weighing 100 lb. per cu. ft. or less, made of heavy gage steel tubing with welded-disc, steel heads (arc welded into a one-piece pulley shell); a "Rex-Stearns" new grey iron idler, of non-corrosive construction, designed for heavy duty service and the handling of abrasive materials; it is cast to uniform wall thickness and ground to exact dimensions. All have Timken tapered roller bearings, all incorporate the one-piece pulley shell construction, a castellated nut and cotter key arrangement for access to and adjustment of bearings, large grease reservoir

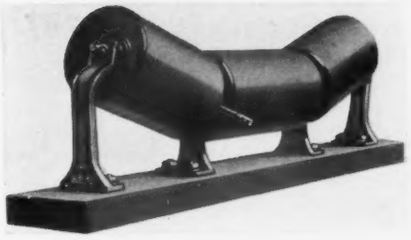


Fig. 36. A line of arc-welded tubular steel conveyor idlers

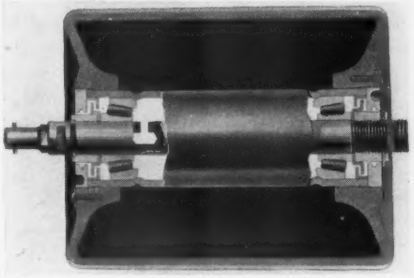


Fig. 37. Construction of pulley of idler shown in Fig. 36

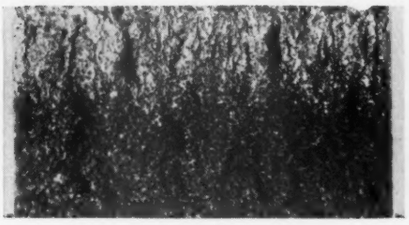


Fig. 38. Section through a chilled cast-iron idler for handling abrasive materials

and a labyrinth grease seal. All units and parts of units are identical and interchangeable. The supporting brackets are made of "certified malleable iron." A section through the chilled face cast-iron idler is shown in Fig. 38.

The development of belt-conveyor equipment has been quite remarkable in the past two or three years, considering the simplicity of the device—all evidence of its greater use for both conveying and elevating.

In the portable conveyor field the George H. Haiss Manufacturing Co., New York, announces that improvements include ball bearings on all its larger sizes of portables with Alemite Zerk system of lubrication. A new tail bearing has been designed with Hyatt roller bearings, with a felt washer outside the bearing to keep out sand and grit. The wheels on the smaller sizes have been equipped with roller bearings for ease in moving them. This company has also redesigned its wire-mesh belt conveyor (Fig. 39) so that the side and return rollers have been eliminated and instead hardwood cleats are attached to the wire mesh, running in at an angle frame, which takes up any side wear on the return side. These wood sides ride on an angle frame. This change is designed to increase the life of the wire mesh over the former use of side rollers and return rollers. These conveyors are finding a field in handling brick, concrete products, etc. They are equipped with a raising and lowering mechanism, and for stacking material can be raised to an elevation equal to one-half the length of the conveyor.

New Graphite Product for Sealing Pipe Joints

THE Joseph Dixon Crucible Co., Jersey City, N. J., has added a new product to its line. This new product is known as "Graphite Seal," a graphite paste for sealing screw threads, flange and gasket joints of pipe lines carrying hot and cold oils. It is insoluble in oils and gasoline. It expands when subjected to heat and is claimed to make leak-proof joints that hold under all conditions of service, yet joints that may be opened with ease.

Fig. 39. Improved wire-mesh belt conveyor for handling brick, concrete products, etc.

Pumps and Dredge Equipment

EARLY in the year the Naylor Spiral Pipe Co., Chicago, Ill., placed on the market a new spiral-welded pipe of wrought iron under the trade name "Spiralweld" (ROCK PRODUCTS, February 18).

Fairbanks, Morse and Co., Chicago, Ill., brought out a new screw pump for handling large volumes of water at low heads with low installation costs (ROCK PRODUCTS, September 29).

The Morris Machine Works, Baldwinsville, N. Y., reports a busy year in new developments, having produced a new line of slurry pumps, medium duty dredging pumps, and heavy duty, lined dredging pumps. The slurry pump (Fig. 47) is designed for handling cement-plant slurry, grinding sand at glass plants and other abrasive mixtures. It is built in 2-, 3-, 4- and 6-in. sizes, equipped with ball-bearings throughout, with large suction intake and an adjustable sealing ring around the suction. The new line of medium duty dredging pumps (Fig. 48) is designed for general dredging where the total head does not exceed 100 ft. This line of pumps is built in 4-, 6-, 8-, 10-, 12- and 15-in. sizes. They have adjustable sealing rings at the suction intake, with a cutless rubber bearing and sealing ring in the hub, with ball thrust and radial bearings outside the pump. The 4- and 6-in. (Fig. 48) pumps of this type are made with overhung shells, while the 8-in. and larger have shells supported on a sub-base. The new heavy duty dredging pumps are built in 6-, 8-, 10-, 12- and 15-in. sizes. They also have an adjustable sealing ring on the suction, a cutless rubber bearing in the hub and ball thrust and radial bearings outside the pump. These pumps are lined throughout with replaceable linings, which can be renewed without disturbing the alignment of the pump or bearings. Fig. 3 shows graphically the results obtained with tests of the 6-in. medium dredging pump. These results, the manufacturer states, prove the contrary of the general belief that high efficiency is not obtainable with the dredging type of pump. All these pumps are made of either semi-steel, carbon steel, or manganese steel, depending on the service intended. For pumping coarse gravel, manganese steel parts are recommended; for materials like sand, carbon or alloy steel; for non-abrasive materials, semi-steel.

Hetherington and Berner, Indianapolis, Ind., have added to their line of dredging pumps a 12-in. "Dreadnought" (Fig. 49), so named because of its ruggedness of construction. The shell, impeller and side-plate liners are of manganese steel. The rest of the pump is made of a special steel alloy "Chromenite." A special feature claimed for this pump is the construction of the main bearing, which is a combination rollway and babbitted bearing, claimed to be capable of withstanding great end-thrust pressures at all speeds. The entire bearing is enclosed and operates in a bath of oil. This type of bearing is claimed to have been thoroughly tried out under all kinds of operating conditions and to have proved non-heating and efficient. Another special feature in the short coupled construction, cutting down the impeller overhang, thus lessening radial bearing strain. The 12-in. pump weighs over 9 tons.

The Fons Flexible Pipe Coupling Co., Royal Oak, Mich., has improved its dredge-pipe coupling so that the two loose rubber rings formerly used as gaskets are replaced by two separate, molded rubbers, shaped to fit each half of the coupling (Fig. 50), and these being riveted to the casting eliminates loose parts. The Fons coupling now consists of two individual upper and lower halves which can be clamped on a pipe to repair a leak, as well as to make a coupling with a flexible joint up to 40 deg.

A. R. Wilfley and Sons, Inc., Denver, Colo., who have supplied the cement industry with many slurry pumps, announce a new 1-in. model "C" sand pump (Figs. 51 and 52). The runner, as illustrated, is made in two pieces, the expeller (the Wilfley pumps are not suction pumps) and the runner being cast separately. The hubs are threaded so that the expeller screws into the runner with the follower plate placed between the runner and the expeller These pumps are especially designed for handling gritty materials and slimes. The 1-in. pump is designed to handle 3 to 35 g.p.m. at total discharge heads up to 50 ft. It is claimed to

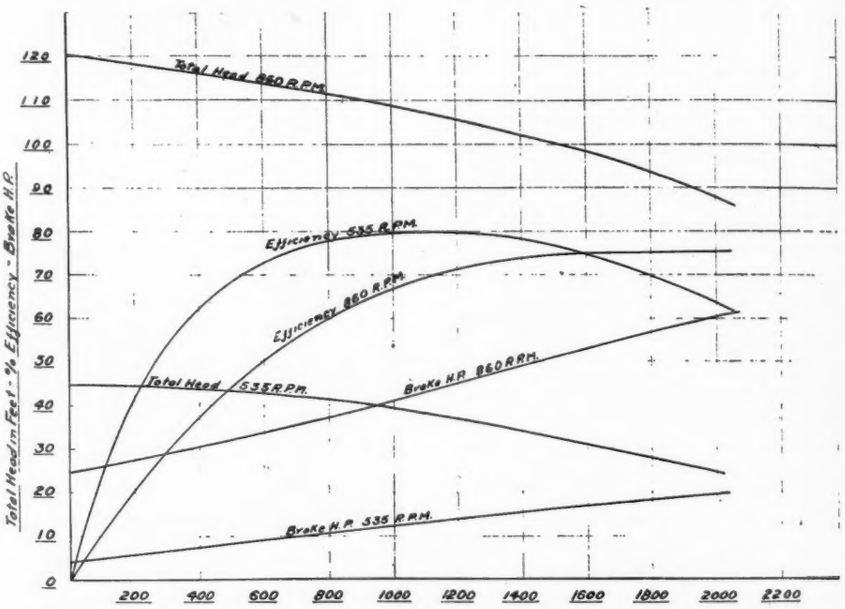


Fig. 46. Performance record of medium-duty dredging pump, demonstrating that high efficiencies are possible with dredge pumps, contrary to general belief

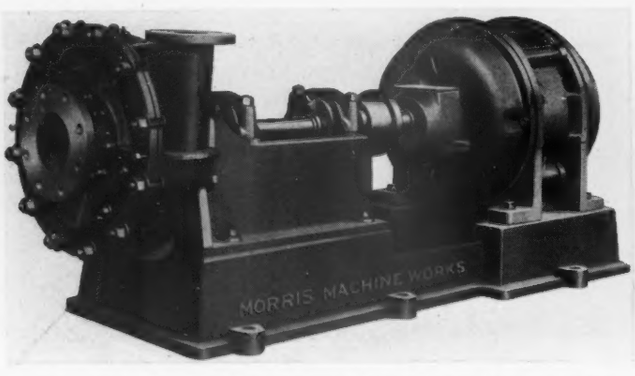


Fig. 47. A new slurry pump for all abrasive materials

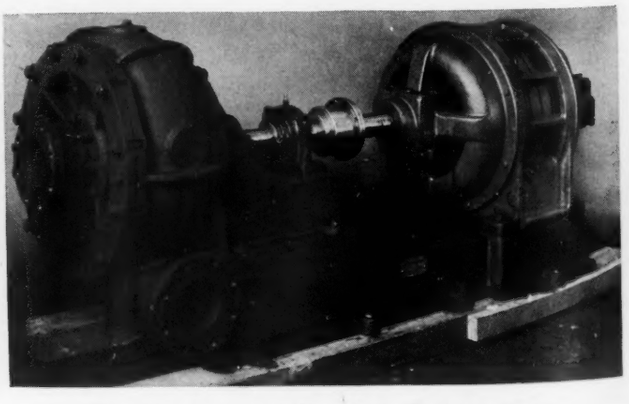


Fig. 48. A new medium-duty dredging pump

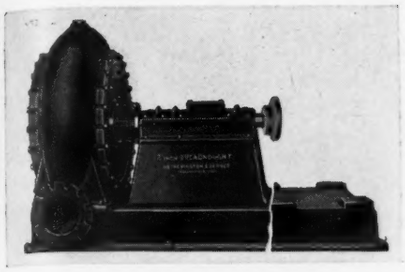


Fig. 49. New 12-in. dredge pump of special steel

represent the first heavy-duty, small-size, sand pump ever placed on the market. The smallest size previously made was 2-in.

This concern also introduced split frames for all its various sized pumps, to render replacements easier. The split frames conform to all the dimensions of the standard solid frames and are divided into two pieces —a base and an intake chamber. These parts are joined together on a horizontal planed joint with a tonge-and-groove arrangement.

Fig. 50. New dredge pipe-coupling parts, which may also be used to repair leaks

Two-piece runners with large expellers for the 1-in., 2-in. and 3-in. pumps are now available for installations which require a pump to withstand high intake heads, said to be a decided improvement in cement slurry pumps.

The American Manganese Steel Co., Chicago Heights, Ill., has added to its well-known line of manganese steel pumps a series of portable units (Fig. 53). The frame or chassis, is of 3-in. channel bars, electrically welded. A ring for a standard

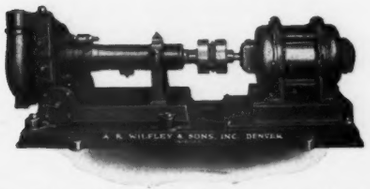


Fig. 51. A 1-in. sand pump for abrasive materials with special features shown in Fig. 52

pintle hook is provided in the frame for towing purposes. Spring shock absorbers on the axle cushion the jars on the equipment in transit. The wheels have roller bearings for ease of traction. These portable units are powered with Novo gasoline engines, although any other power unit of 1200 r.p.m. may be substituted on request. The pump has manganese-steel shell, impeller and disks. A long, ring-oiling, babbitted, sleeve bearing supports the shaft to which the impeller is press-fitted. The drive shaft is lubricated by a large oil reservoir, which also lubricates the thrust bearing. The sizes of the various units vary from a 2-in. discharge pump, powered with a 6-hp. motor to a 3-in. discharge with a 10-hp. motor, the capacities ranging from 100 g.p.m. against a 34-ft. lift for the 2-in. to 230 g.p.m. for the 3-in. against a 37-ft. lift. The truck chassis in all cases is 9½ ft., length over all, 4 ft. 11 in. wide, and 4 ft. high.

The Eagle Iron Works, Des Moines, Ia., announce that it has completely redesigned the Swintek nozzle for sand and gravel dredges, and while the weight is slightly less than the older design, it has been given eight times the structural strength in the present ladders. This has been brought about by the use of gusset plate construction and the design of ladders along the same structural lines as a bridge truss. The nozzle end of the ladder has been made a rigid plate and angle structure and the side bracing has been increased to eliminate sway from the structure. A special clamp flange has been designed, connected on welded rings around the end of the

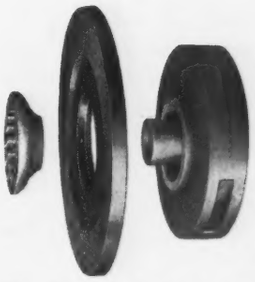


Fig. 52. Special parts of sand pump shown in Fig. 51—said to be the smallest sand pump made

pipe, in order not to diminish the effective thickness of the pipe through threading for screw flanges. All nozzles are equipped with double-strength pipe. The size and weight of the cut gears on the drive of the Swintek chain have been increased and a standard "Eagle" friction clutch has been incorporated in the driving mechanism. This clutch has been used for many years in the company's dry pan crusher and has thoroughly proven itself, it is claimed. A new screen chain of manganese steel and manganese steel sprocket are other new features. All these new features are designed for ruggedness and to prevent excessive wear.

During the year, Hardinge Co., York, Penn., developed a diaphragm sludge pump, which, it is presumed could be used for pumping cement slurry. The quantity pumped, it is claimed, can be regulated without stopping the pump. It does not lose static head when the flow is interrupted (Fig. 53-A).

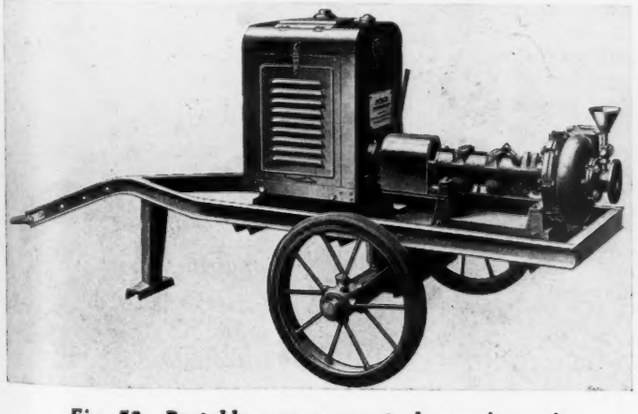


Fig. 53. Portable manganese-steel pumping unit

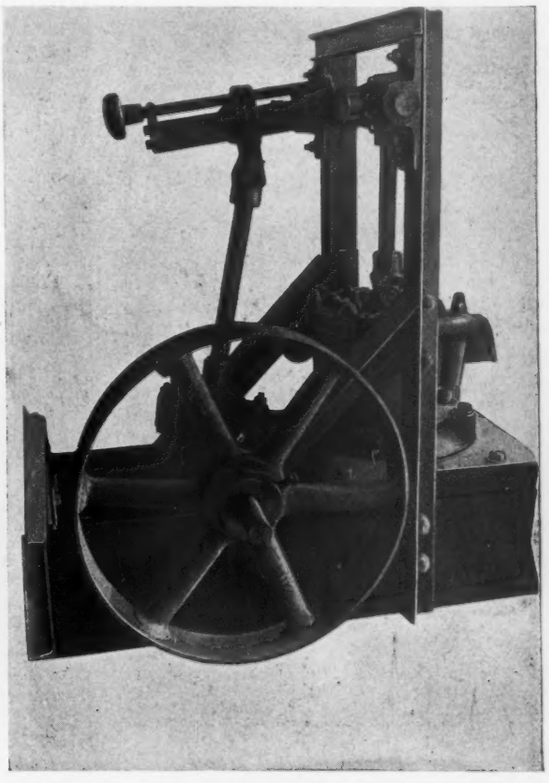


Fig. 53A. A new type of sludge or slurry pump

Electrical Equipment

THE YEAR 1928 was one of much activity on the part of manufacturers of electrical equipment for the rock products industry. The Magnetic Manufacturing Co., Milwaukee, Wis., brought out a new type of magnetic separator (ROCK PRODUCTS, February 4). The Cleveland Electric Motor Co., Cleveland, Ohio, placed on the market a fan-cooled, totally enclosed motor (ROCK PRODUCTS, November 24). The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., introduced a new line-start induction motor (ROCK PRODUCTS, March 3) and a new line of totally enclosed motors, 1- to 50-hp. (ROCK PRODUCTS, November 10).

Descriptions of new General Electric Co., Schenectady, N. Y., equipment have been published during the year as follows: Drum switches (March 3); air-jacketed motor (April 14); limit switch for control circuits (May 26); magnetic switch to throw motors across the line (July 7). Other new products included an automatic brake which permits push-button control of super-synchronous motors (Figs. 83-85). This brake eliminates the necessity of hand-braking super-synchronous motors. The brake mechanism consists of an upright standard which supports a vertical shaft. The lower part of the shaft is threaded. When it is revolved it transmits motion, through a trunnion block, to a series of levers attached to the brake band. The driving motor for the brake is mounted on the side of the standard and is geared to the screw shaft. A wheel is mounted on the end of the shaft, so hand braking may be used at any time. When the brake is released the trunnion block travels upward on the screw, and is stopped by the tripping of a limit switch, when sufficient clearance has been obtained between the brake band and the motor frame. In tightening the brake, the trunnion block moves down on the screw, automatically applying tension to the brake band through the combination of levers and weights, until the action is stopped by a limit switch. It is impossible for the brake to apply more torque than the amount corresponding to the weights on the lever brakes; by adjustment of the weights the starting time may be varied, as from 5 to 40 seconds.

A new G.-E. "signal" relay that warns when the power fails or voltage drops is illustrated in Fig. 86. In operation the coil circuit of the relay is connected across the two legs of the power supply which it is desired to watch. When the coil is thus energized, the relay contacts are held open. When the coil is de-energized the contacts close and a circuit to a warning signal is completed. A complete new line of starters

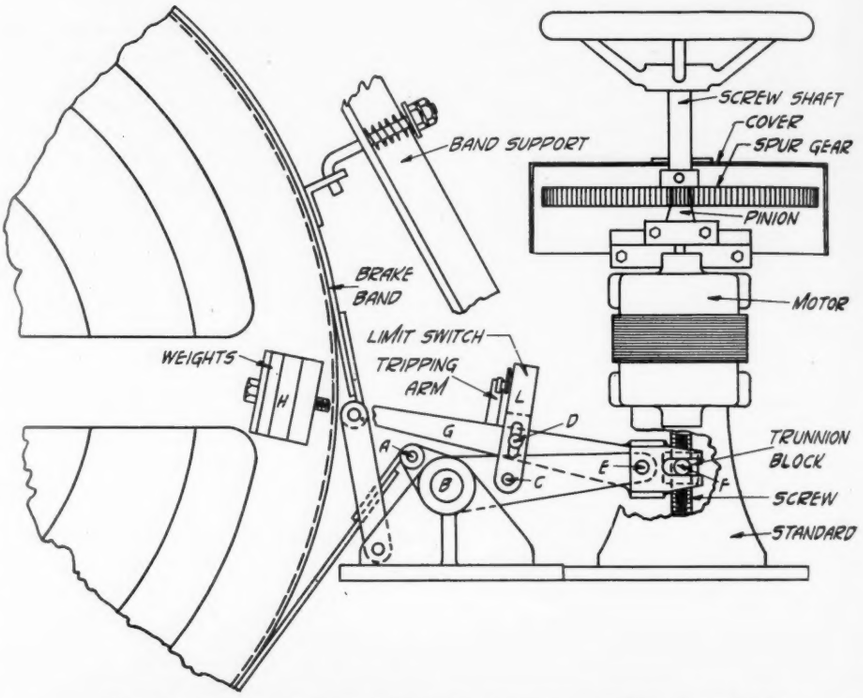


Fig. 83. Details of automatic brake for super-synchronous motors

Fig. 84. Motor-operated automatic brake on super-synchronous motor, Nazareth Cement Co. plant

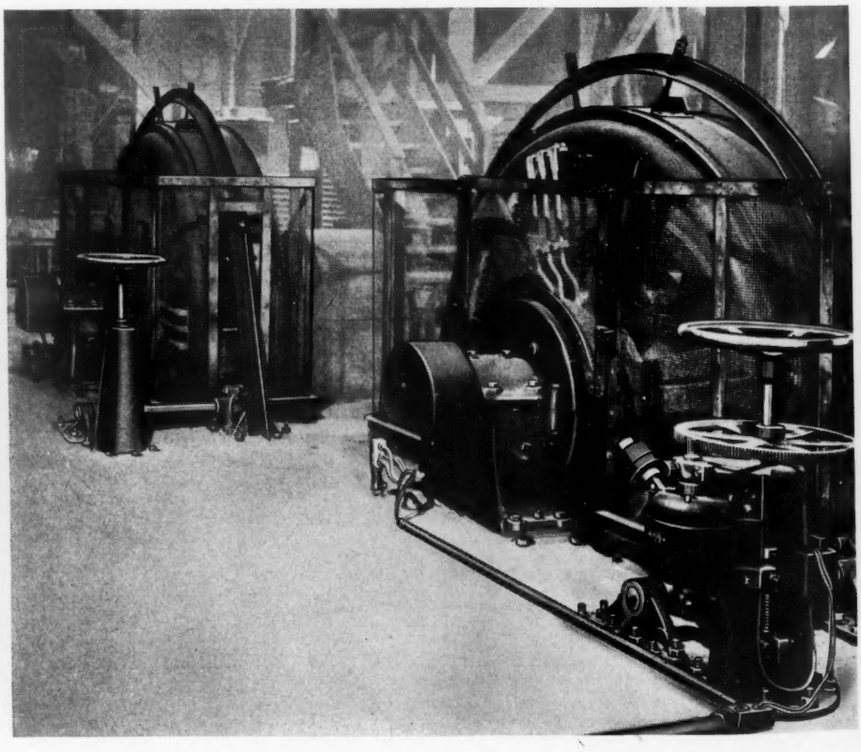


Fig. 85. Nazareth Cement Co. plant; hand-operated super-synchronous motor brake in background, new automatic in foreground

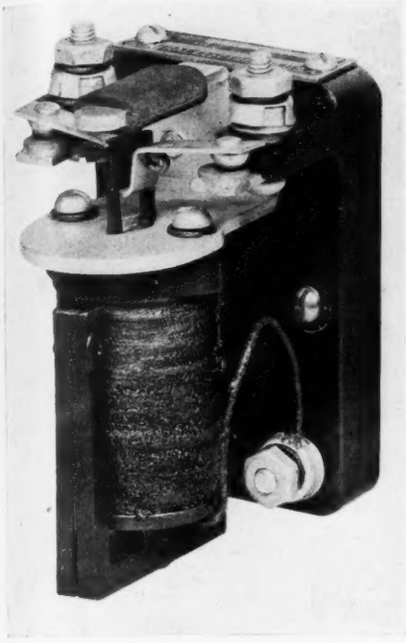


Fig. 86. Under-voltage relay

for d.-c. motors (Figs. 87 and 88) was brought out, designed to provide definite acceleration for constant- and adjustable-speed motors. The principal advantages claimed are a reduction in size, an increase in the number of accelerating points, and improved appearance. Fig. 87 illustrates the starter for general purpose applications, and Fig. 88 the adjustable-speed-motor type. Thermal overload protection is provided by means of single-coil relays, which operate under extreme conditions as a warning that the motor or wiring needs attention.

A new G.-E. control for automatic arc welding which eliminates the arc crater is shown in Fig. 89. This is accomplished by stopping the feed to the electrode wire a short time before shutting off the welding current at the end of the wire, which clears the electrode from the weld and fills the crater at the end of the weld when the arc is cut off. A new line of primary-resistance drum switches for squirrel-cage induction motors on small cranes, hoists, etc., is illustrated in Fig. 90. It is a primary reversing switch and the capacity is rated in horsepower, designed for wall mounting. Dust-tight covers are provided for cement-plant and similar uses. It is made in two forms, for hoists where the motor is overhauled in the lowering direction and for hoists where the motor is not overhauled in the lowering direction. An example of the former is a hoist with spur gearing and no automatic mechanical load brake. An example of the latter is a hoist with spur gearing and no automatic load brake.

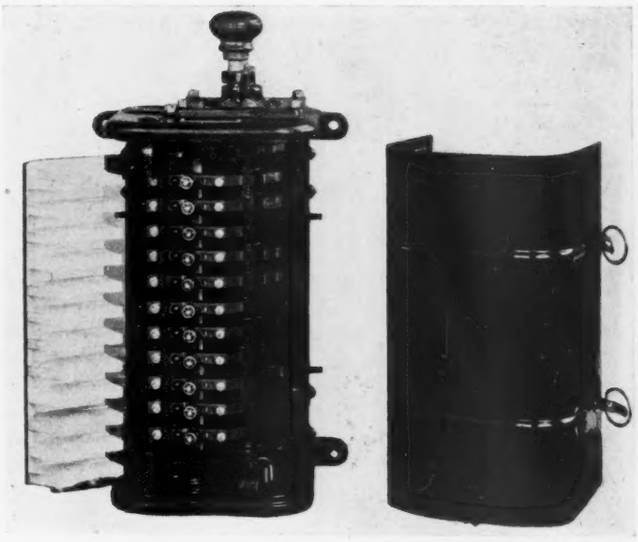


Fig. 90. Drum switch for squirrel-cage motors

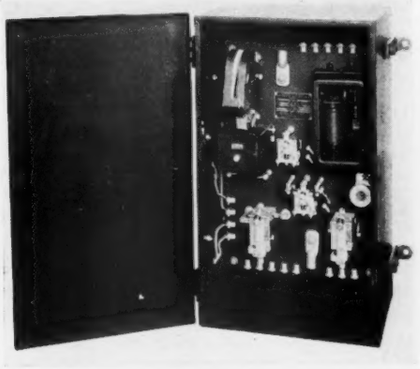


Fig. 89. Panel for automatic arc welding

A G.-E. protective panel specially designed to take less space in the crane cab is shown in Fig. 91. Such panels provide overload and under-voltage protection for all the motors of a crane and are designed to be used with an emergency switch by the operator in an emergency. They may be used with either drum switches or magnetic control panels. The chief change made in the new line is a regrouping of the units involved, resulting in a reduction in size. Another change is the substitute of instantaneous overload relays instead of dash-pot relays.

Figs. 92 and 95 show a new G.-E. control panel for charging six vehicle batteries, each of the 42-cell, 13-plate type, of interest to many sand, gravel, stone, etc., operators who maintain fleets of trucks. The panel is for use in conjunction with a motor-generator set consisting of a 27-kw., 110-v. generator driven by a 40-hp., 550-v., 3-phase, 60-cycle motor. In connection with a magnetic starter for the motor, the panel provides overload protection for the generator, restarting the set and resumption of charging after line failure, and full automatic shutdown after completion of the charging of the batteries.

A new G.-E. control switch suitable for reversing small alternating current motors in cases where the motor can be thrown across the line is illustrated in Fig. 93 (with drawn-steel cover removed). It consists of two triple-pole, barrier-type, magnetically operated contactors,

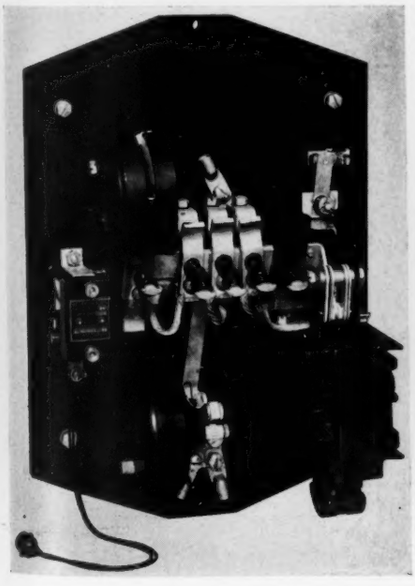


Fig. 87. Automatic starter for d.-c. motors

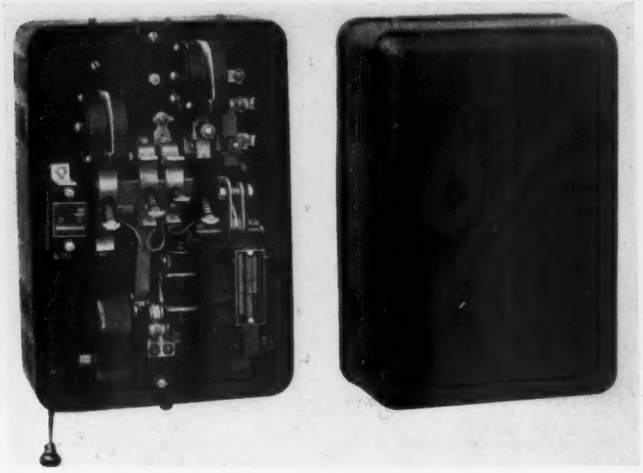


Fig. 88. Automatic starter for variable-speed d.-c. motors

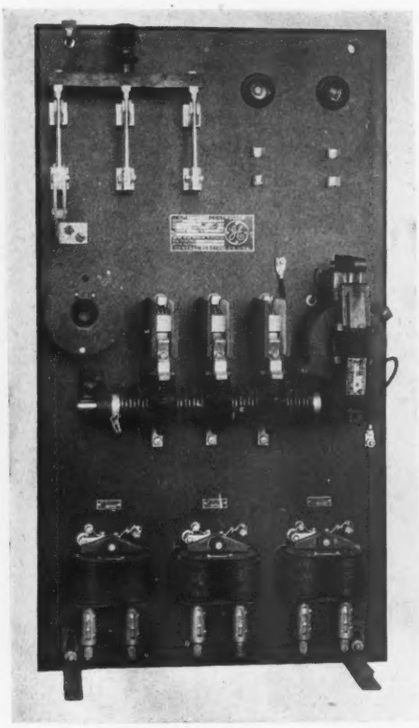


Fig. 91. Crane protective panel

mechanically and electrically interlocked, and two hand-reset temperature overload relays, mounted on a molded base and enclosed in a draw-shell enclosing case. Two temperature overload relays protect the motor from overheating because of mechanical overload or single-phase operation. A new G.-E. automatic circuit-breaker is illustrated in Fig. 94, designed for use on 125-volt alternating or direct current, with ratings of 6, 10 and 15 amperes. It was developed to control and protect branch lighting circuits, as well as

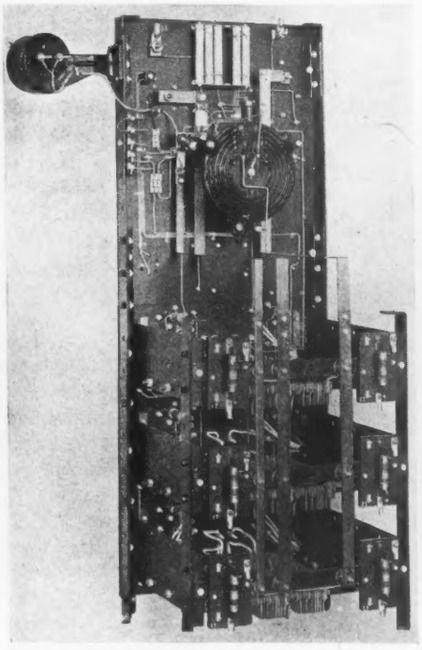


Fig. 92. Panel for charging batteries

small motor-driven apparatus. The General Electric Co. also announced during the year an improved, single-phase, repulsion induction motor in ¾-, 1-, 1½- and 2-hp. sizes at 1800 r.p.m., supplementing its present line of "SCR" motors. For repairing railway and industrial haulage motors the company developed an ingenious device which indicates the exact strain or tension in pounds applied to the steel binding wire by the binding machine or lathe.

The Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., introduced the salient-pole synchronous motor for cement tube-mill, and similar, drives (an article on these appears elsewhere in this

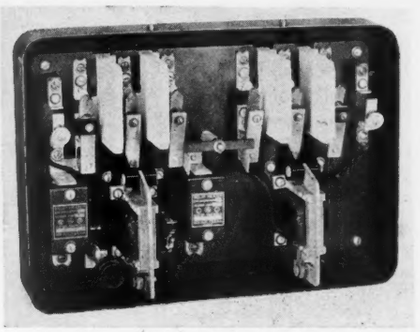


Fig. 93. Cross-the-line reversing switch

issue). Recently this company announced a new line of portable alternating current measuring and testing instruments (Rock Products, November 10) and later a new line of direct-current instruments (Rock Products, November 24).

A new Westinghouse thermal relay device is illustrated in Fig. 96, which, it is claimed, retains calibration and automatically permits the safe overload capacity of the motor to be utilized. The thermal device follows the heating curve of the motor (Fig. 97), which means the motor will not shut down instantly in case of high but harmless over-current demands.

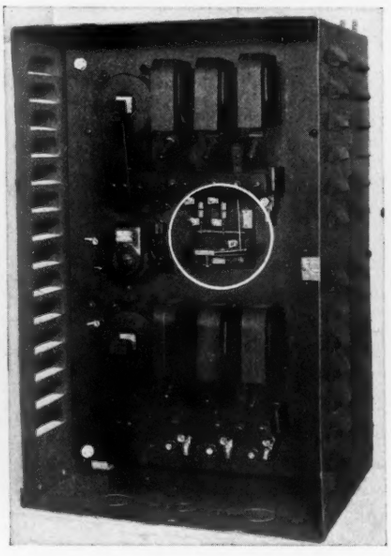


Fig. 96. Thermal relay device

Fig. 94. Automatic circuit breaker

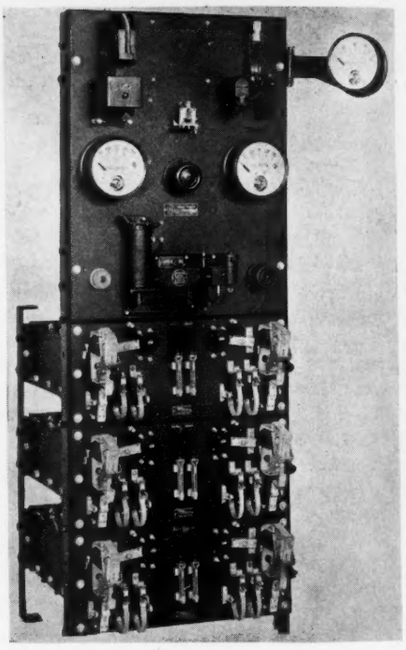


Fig. 95. Panel for charging batteries

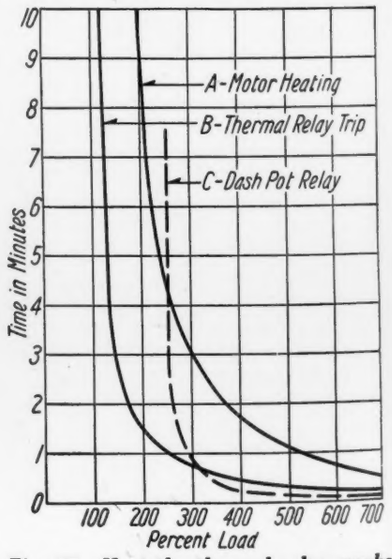


Fig. 97. How the thermal relay works

Air Compressors

THE Pennsylvania Pump and Compressor Co., Easton, Penn., announced a new semi-portable, single-stage, double-acting, multiple-belt-driven air compressor (ROCK PRODUCTS, June 9), and a new air-cushioned air-compressor valve (August 4).

The Sullivan Machinery Co., Chicago, Ill., produced a new line of angle-compound compressors (Fig. 108) designed to secure the benefits of balanced compound performance and design in units as small as 300 cu. ft. displacement, and in pressures from 50 to 1000 lb. per sq. in. They have an 8-in. stroke, a 12-in. intake cylinder and a 7½-in. discharge cylinder.

The Ingersoll-Rand Co., New York City, is just announcing a new direct-connected, gas-engine-driven compressor (Fig. 109), known as Type XG. It consists of a 2-cylinder, 4-cycle, gas engine direct connected to I.-R. compressing cylinders with I.-R. plate-type valves. Its special features are rugged construction, accessibility of frames and running gear, economy of floor space.

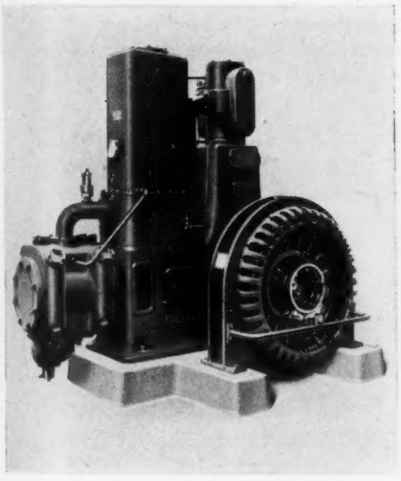


Fig. 108. New line of angle-compound compressors

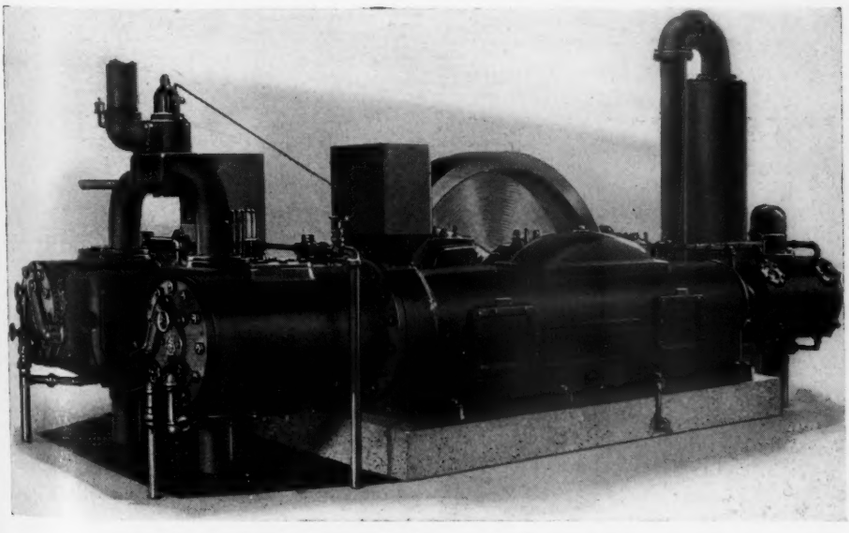


Fig. 109. New direct-connected, gas-engine-driven compressor

Air Separators

THE Sturtevant Mill Co., Boston, Mass., has extended its well-known "Whirlwind" line of air separators to include one 16-ft. in diameter. These separators are now made in sizes of 3, 5, 6, 8, 10, 12, 14 and 16 ft.

The Rupert M. Gay Co., New York City, developed a new air separator (Figs. 110 and 111). The weight has been increased, over the former types, angles and channels have been added to the outer shell to facilitate erection and prevent damage in transit; the angle of the conical section has been increased, and flat shelves under the deflectors have been eliminated, to prevent sticky materials from building up and choking the separator. A new type of centrifugal fan has been provided, so that, it is claimed, adjustments for fineness between 60- and 325-mesh and finer can be made in five minutes without the use of tools. When the separator is used for abrasive materials the separating chamber is supplied with replaceable liners. A new oiling system has been designed. The separator is made in eight sizes from 30-in. to 18-ft. in diameter.

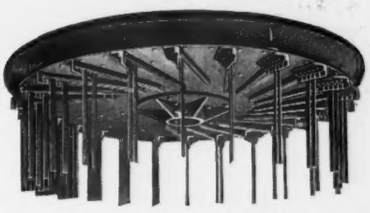


Fig. 110. Details of new design of air separator

Fig. 111. Improved air separator

Dust Arrestors

DUST arrestors used in the rock products industries are of two general types—filters for intakes of air compressors, gas engines, etc.; and large mechanical dust

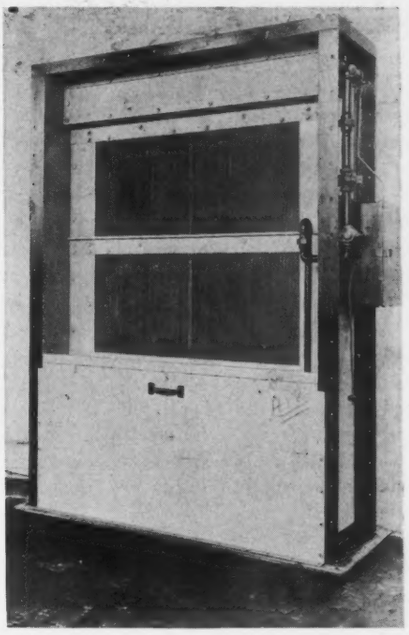


Fig. 112. Air filter for compressors, gas engines, etc., with new features

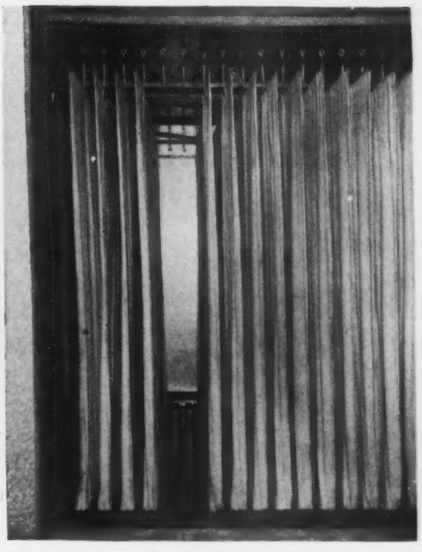


Fig. 113. New flat-bag for dust collector showing possibilities of close nesting of bags

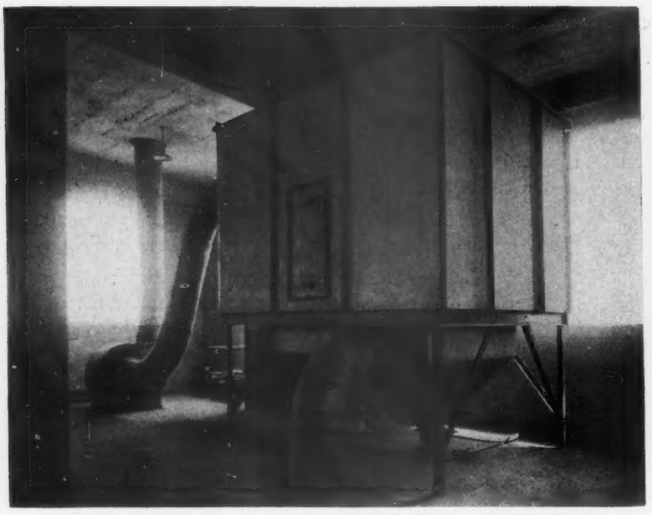


Fig. 114. Installation of new flat-bag dust collector

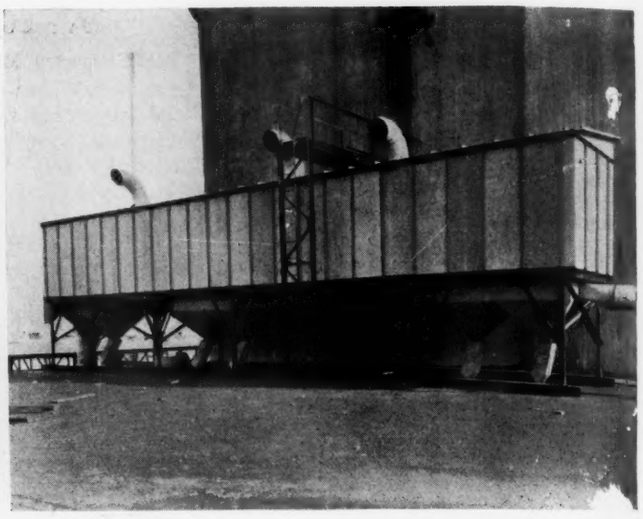


Fig. 115. Compactness of new dust-collector illustrated

arrestors or collectors for both hot and cold dusts and smoke.

In the first class the Reed Air Filter Co., Louisville, Ky., announced a new automatic, self-cleaning filter (Rock Products, September 1). The Staynew Filter Corp., Rochester, N. Y., a filter specially designed for air pipe lines (Rock Products, July 21).

The Midwest Air Filters, Inc., Bradford, Penn., are just announcing a new development known as the "Midwest" "horizontal" and "vertical" air filter (Fig. 112 shows the vertical type). Its operation depends on a flow of air through specially designed "sinuous" filter plates and cells, the plates being coated with "viscosine." Its chief claim for high efficiency is that "the energy used in accelerating the air flow (after retarding) is used up in accelerating the air flow and not dissipated as in the multiple-baffle type, but is regained by application of the Venturi principle and is transmitted unimpaired to the outgoing air stream." The distribution of the oil in the "sinuous" bends of the plates is claimed to be such as to make it more effective than on ordinary plate baffles. Other davantages claimed are compactness and ready accessibility to plates and oil tank.

In the second class of large mechanical dust collectors, the American Blower Co., Detroit, Mich., entered the field with a new imported type known as the Davision (Rock Products, January 7).

Both the W. W. Sly Co., Cleveland, Ohio, and Northern Blower Co., Cleveland, made numerous installations in the cement industry, which are referred to in the review of the cement industry elsewhere.

The Parsons Thompson Engineering Co., Cleveland, Ohio, has taken over the engineering, manufacture, marketing, and installation of the "New Haven" dust arrestor (Figs. 113-115). In doing so they have designed an entirely new device, it is claimed. It has a filtering unit of the flat-bag type instead of the usual tubular type. Each unit is made up of 12 sections, arranged to be quickly replaced. These flat-bag units are nested closely, permitting a large cloth area in a limited space. The vertical seaming of the bags into 12 sections is to prevent their bulging into each other and to reinforce the bag itself.

The bag units are clamped down at the bottom by four thumb screws into 2-in. steel channels, which act as baffles and prevent cutting the cloth at the bottom, as well as making the structural frame for support. The bags at the top are supported by a ½-in. rod inserted in the top hem and suspended by turn-buckles from above. The twin buckles are supported by individual springs, which limit the tension of each bag unit.

The shaking of the bag is horizontal, and in an arc, the shaking rods passing through the center of the turn buckles, but not rigidly fastened to them, enablying a horizontal movement without undue tension in the bag unit. All the turn-buckle screws and small adjustment parts are cadmium plated to resist the action of condensation and resulting rust. The arrestor cases are made of galvanized sheets. The shaking mechanism is on top of the arrestor, at the end, and consists of a small reduction gear and a direct-connected motor by an accentric to the shaker arms passing through the turn-buckles.

The new dust arrestor was developed by S. S. Parsons, western manager of the New Haven Sand Blast Co., and is covered by New Haven and Parsons' patents. Mr. Parsons is the president of the Parsons Thompson Engineering Co.

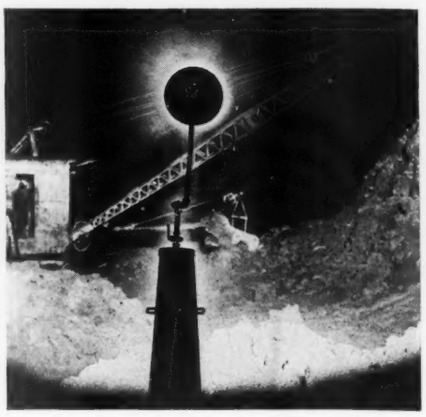


Fig. 115-A. New flood light

Flood Light Attachment

THE Prest-O-Lite Co., New York City, is announcing a new flood-light attendment for use with small tanks of discharged oxygen (Fig. 115-A). The reflector is 10 in. in diameter and can be taken off by removing a single knurled nut. A new type burner is used, designed not to "carbon" placed at a fixed focal point.

Sand-Lime Brick Machinery

THE Jackson and Church Co., Saginaw, Mich., designed and placed on the market a new motor-driven press (Rock Products, March 17).

The Hardinge Co., New York City, installed a 4 x 10 conical-ended, rod-mill in a Canadian sand-lime brick plant, believed to be the first mill of this type placed in this industry. The special advantage claimed for this mill is that the rods align themselves horizontally in the cylindrical portion of the mill while it is operating, leaving the conical ends free for feeding and discharging the materials. This has made it possible to handle damp material in the mill. To facilitate the discharge of a damp material and to prevent packing, discharge ports are arranged in the periphery of the mill near the junction of the discharge cone and cylinder. At the Hinde Bros., Toronto, Ont., plant, a 4 x 10-ft. mill of this type, operating at 23 r.p.m., is said to have a capacity of 14 tons per hour with a mixture of sand and lime containing as high as 6% moisture at times; the mill requiring about 30 hp., with a load of 7000 lb. of 3-in. and 2-in. high-carbon steel rods. The mill is placed horizontal.

Speed Reducers—Power Transmission

THE USE of speed reducers and similar devices has become so universal in the rock products industries that there is no longer a news element in merely new installations. Nevertheless, manufacturers of these power-transmission devices have gone on improving them.

The Fawcus Machine Co., Pittsburgh, Penn., early in the year produced a new type of worm reduction gear (ROCK PRODUCTS, January 21). The Union Chain and Manufacturing Co., Sandusky, Ohio, developed a new expansible sprocket (ROCK PRODUCTS, April 28). The D. O. James Manufacturing Co., Chicago, Ill., announced a line of new, generated, continuous-tooth, herringbone speed reducers (ROCK PRODUCTS, July 7). The Palmer-Bee Co., Detroit, Mich., put out an entirely new line of herringbone speed reducers (ROCK PRODUCTS, November 24).

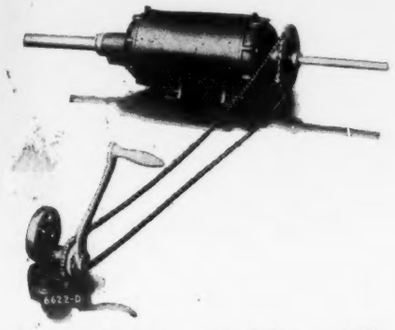


Fig. 99. Remote control for variable-speed transmission

Morse Chain Co., Ithaca, N. Y., a new flexible coupling using the chain-drive principle (ROCK PRODUCTS, December 8). This company also makes a line of speed reducers using the chain-drive principle.

The Stephens-Adamson Manufacturing Co., Aurora, Ill., has added a refinement to its "JFS" variable speed transmission, a remote control arrangement (Fig. 99). The shaft extension at the left of the reducer is direct-connected to a constant-speed motor, or other power source, the other end to the driven machine. By turning the hand crank shown the operator can increase or decrease the speed of the shaft driving the machine to suit its requirements. A dial geared to the hand crank can be calibrated to show the exact speed at which the machine is operating.

The Farrel-Birmingham Co. announced a new and complete series of speed reducers (Figs. 100-102) which have Sykes continuous tooth herringbone gears and anti-friction bearings. The improvements claimed are: (1) Roller bearings that combine journal and thrust capacity on both pinion and gear shafts; (2) mechanical efficiency increased from 98½% to 99% for single reduction, and from 98 to 98½% for a double reduction; (3) simpler lubrication than with plain bearings; (4) considerable saving in space; (5) roller bearings being interchangeable, it is possible to make gear units interchangeable and, by manufacturing them in larger quantities, reduce initial cost.

The Traylor Engineering and Manufacturing Co., Allentown, Penn., entered the geared, speed-reducer field with a speed reducer especially designed for driving rotary kilns, coolers, dryers, etc. (Fig. 103). The housing or case contains a main driving pin-

Fig. 103. Geared speed reducer particularly designed for driving rotary kilns, dryers, coolers, etc.

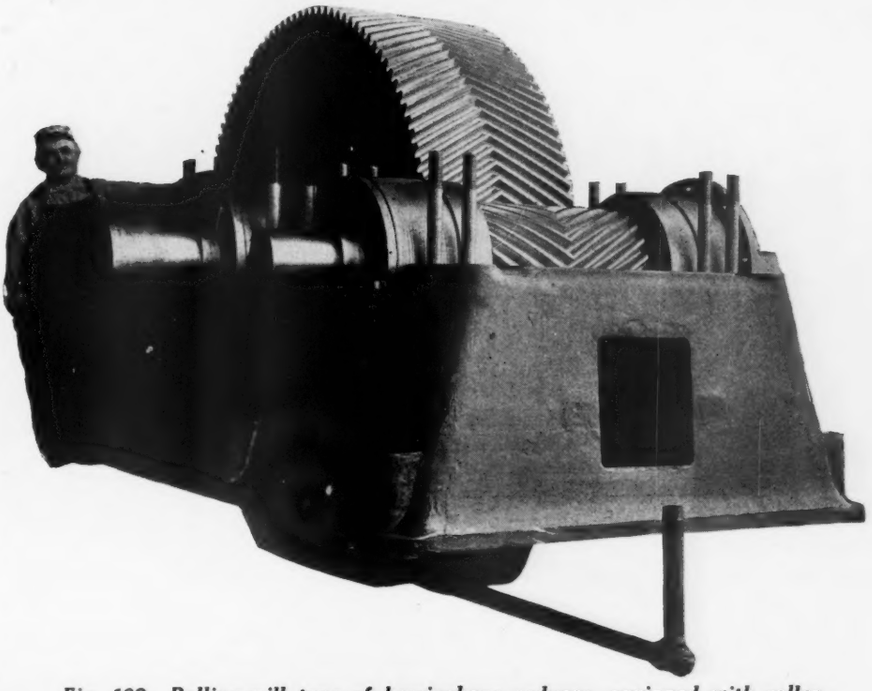


Fig. 102. Rolling-mill type of herringbone reducer, equipped with roller bearings—300 to 500 hp.

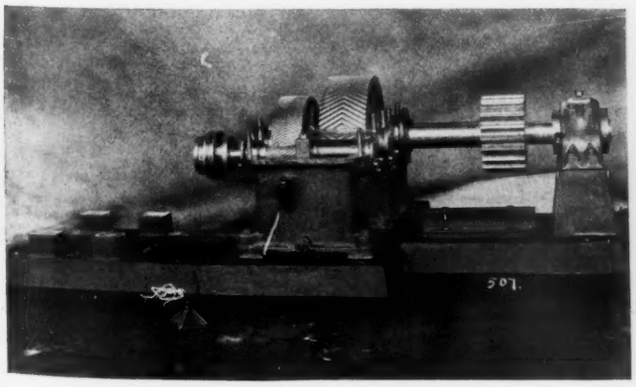


Fig. 100. Herringbone geared speed reducers with roller bearings—double reduction 10:1 and 60:1 for between 5 and 200 hp.

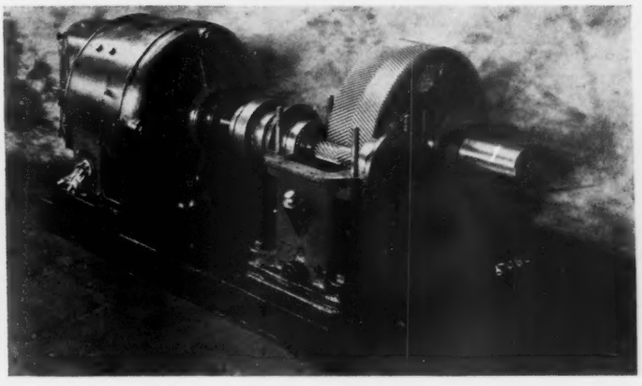


Fig. 101. Motor and herringbone speed reducer unit on common base plate; reducer 2:1 and 10:1 for 30 to 300 hp.

ion and three sets of reduction gears, all with cut teeth with the addenda of the pinion teeth increased slightly to lengthen the contact arc. All the shafts are fitted with Timken roller bearings, inserted through openings in the sides of the housing, with a fabricated guard provided for the main gear of the unit, as closely fitting the shell as will permit operation. The gears and the main pinion run in oil. The advantages claimed for this reduction unit for the purposes noted is that the original alignment is greatly facilitated and is permanently maintained, so that the whole may be slid away from engagement, to make the girth gear accessible, and returned to position with no adjustment, except horizontally.

The D. O. James Manufacturing Co., Chicago, Ill., have announced a new improved, vertical-type, heavy duty worm gear speed reducer (Fig. 104). This is made to allow for vertical driving with shaft projecting either top or bottom. Timken bearings support both sides of the gear shaft. The worm shaft is mounted on double Timken bearings on one side, and Norma Hoffman roller bearings on the other. Gear shafts are 0.40 carbon steel, ground to size; worms are made integral with worm shafts, of chrome nickel steel. Gears are made of phosphor bronze, the larger sizes being made up of a bronze ring, shrunk on and keyed to a cast-iron spider. From 20- to 30-deg. pressure-angle teeth are standard, depending on the number of teeth in the worm and gear.

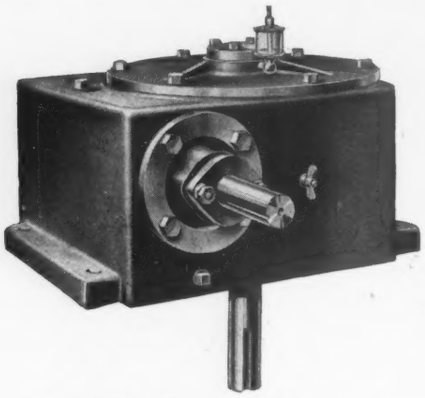


Fig. 104. Worm-geared vertical speed reducer

Another new James product is a combination backstop and flexible coupling (Fig. 106). It is designed for use on elevators, conveyors, etc., to prevent their travel backward when loaded and standing, or when the motor is shut off. This device consists of a drum-shaped housing, on the back of which is integrally made one half of a flexible coupling, which contains free flexing, live rubber bumpers, and in which are cemented bound brook oilless bushings. A half coupling fitted with hardened and ground steel pins which float inside graphite-impregnated bronze bushings, a ratchet plate, three pawls with studs, springs, fastening bolts and two-piece cover complete the unit. The backstop is applied on the drive shaft between a speed reducer and motor. A flange attached to the speed-reducer housing is cast integral with a ratchet. This ratchet operates within the drum housing, which in turn is connected to the motor shaft through a flexible rubber bumper type coupling. On the inner face of the housing the three pawls are secured by studs, which engage with the ratchet the moment the housing stops revolving. Centrifugal force keeps the pawls out of engagement with the ratchet during operation.

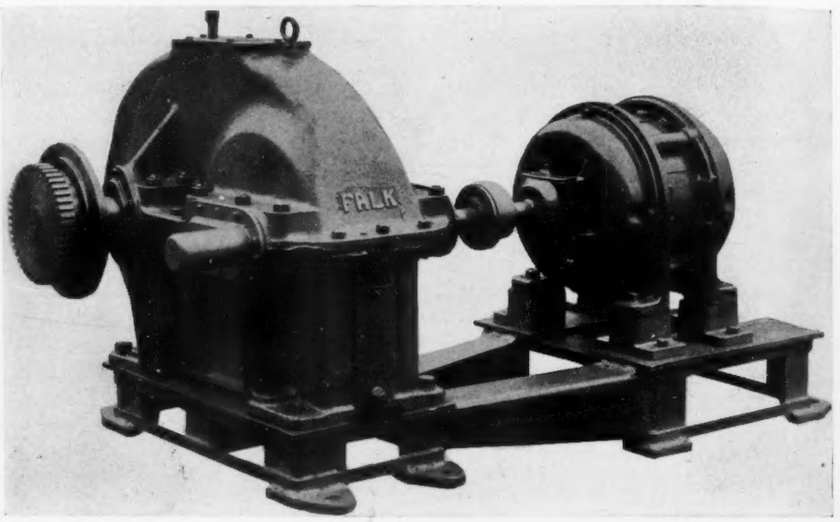


Fig. 105. New bed plate for speed reducer and motor furnished with new line of reducers

The Falk Corp., Milwaukee, Wis., announces that after a series of exhaustive tests it has added certain refinements to its line of speed reducers. Several new sizes have been added, including four new single reduction units, three double-reduction, and three triple-reduction, plus nine sizes of single-reduction with vertical centers, now making a total of 48 different standard sizes. A complete line of welded motor beds (Fig. 105) has been added. Low speed shafts have been changed from 0.50 to 0.60 carbon steel to alloy steel. Another improvement is a new method of forging pinions. A new lubrication plate attached to the base of the gear plate gives instructions as to the proper grade of oil to be used under every conceivable operating condition.

The W. A. Jones Foundry and Machine Co., Chicago, Ill., is announcing a new semi-steel, molded pulley, a material improvement, it is claimed, over the older style cast-iron pulley.

The Link-Belt Co., Chicago, Ill., announce that their silent-chain (Fig. 107) drives are now available from stock in sizes from ½ to 10 hp., as a joint result of standardization and quantity production.

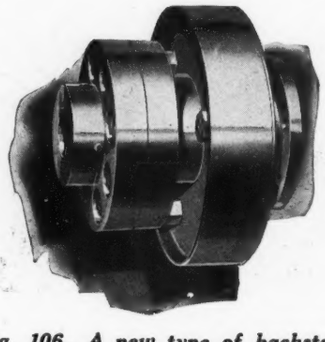


Fig. 106. A new type of backstop for elevators, conveyors, etc.

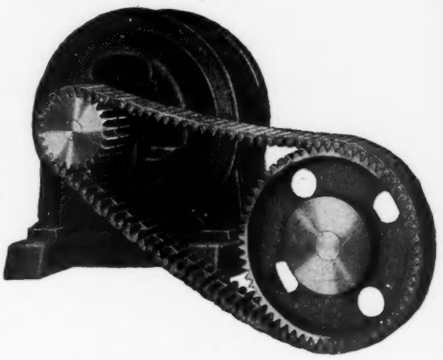


Fig. 107. Chain drive transmission

National Equipment Corporation Acquires Two More Manufacturing Concerns

A RECENT announcement states that the National Equipment Corp. has acquired the Parsons Co. of Newton, Iowa, manufacturers of power trench excavators, and also the Insley Manufacturing Co., of Indianapolis, manufacturers of steel towers for hoisting and pouring concrete. The National controls the Koehring Co. and the T. L. Smith Co., so that the acquisition of the two other companies brings its total assets up to $9,000,000. Both the Parsons company and the Insley company will continue under their present management as divisions of the controlling company. H. C. McCardell, president of the Parsons Co., and W. H. Insley, president of the Insley Manufacturing Co., will become vice-presidents and directors.

Prime Movers

BUILDERS of gasoline and oil engines have been busy, as usual, in 1928. The Buda Co., Harvey, Ill., announced a new Buda M. A. N. 92-hp. Diesel engine (Rock Products, February 4). Now this company is bringing out another (Fig. 78) 180-hp. This is a 6-cylinder, 6½x8¾ high-speed full Diesel, weighing 5400 lb. Compressed air is not used for starting or running this engine. A small, air-cooled, 2-cylinder, gasoline engine mounted on a bracket, which is cast on the flywheel housing, is used to start the engine. Electric starters can be substituted.

The Waukesha Motor Co., Waukesha, Wis., announced a new 4-cylinder gasoline motor (Rock Products, February 18); later a new automatic gas mixer (Rock Products, April 28). The Andrews-Bradshaw Co., a division of the Blaw-Knox Co., Pittsburgh, Penn., developed a purifier for air, gas and steam lines (Rock Products, March 17). The Perfex Corp., Milwaukee, Wis., brought out a radiator for Diesel engines (Rock Products, April 14). The Climax Engineering Co., Clinton, Iowa, announced a new 4-cylinder gasoline engine, known as the "Blue Streak" (Rock Products, October 27). This company is now announcing another "Blue Streak" motor with 6 cylinders (Fig. 81). The 4-cylinder models have 6-in. bore and 7-in. stroke, developing 100 to 110 hp. at 1000 to 1200 r.p.m. The 6-cylinder is of similar design and develops 150 to 160-hp. at 1000 to 1200 r.p.m. In Rock Products, June 9, the Climax company announced a new automatic spark control for heavy-duty engines.

The latest Hercules Motors Corp., Canton, Ohio, motor is shown in Figs. 79 and 80.

The Continental Motors Corp., Detroit, Mich., also has a new line of 6½x7½-in. stroke gasoline industrial motors (Fig. 82). There are eight models in the entire series. The engines are 4-cylinder, valve-in-the-head, with a range of from 39 to 125 hp. In the design have been incorporated such engineering refinements as removable cylinder sleeves, overhead valves, large crankshaft with five main bearings, dry sump oiling system, built-in governor and longer and better proportioned pistons. The removable sleeve cylinders are made of nickel iron and the cylinder heads also are of nickel iron, cast in pairs.

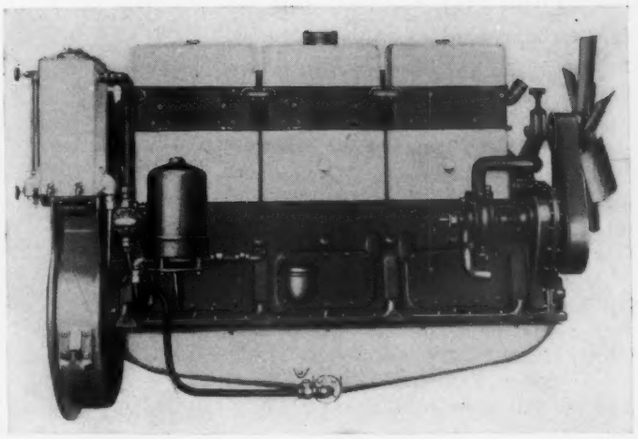


Fig. 78. New 180-hp. full Diesel engine

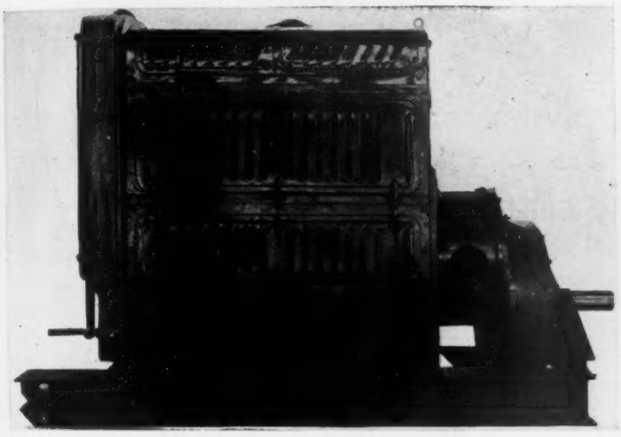


Fig. 79. A new gasoline engine

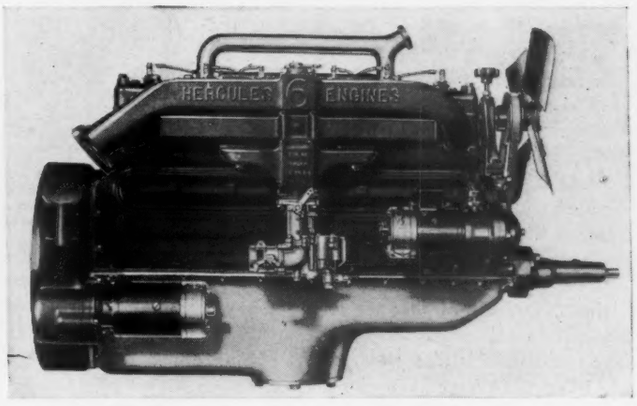


Fig. 80. Engine shown in Fig. 79, with covering removed

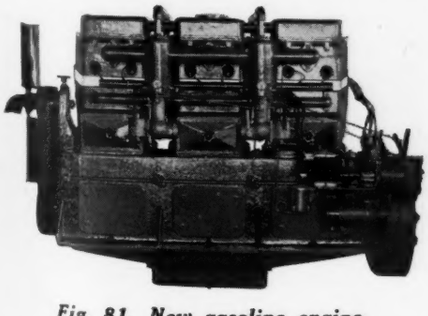


Fig. 81. New gasoline engine, 100 to 110 hp.

A number of interesting applications of gas and oil engines were noted in 1928. In the review of the crushed-stone industry mention is made of several Diesel engine installations and some cost figures are given. In Rock Products, August 4, a description was given of a two-stage 16x10x14-in. air-compressor installation, driven by 4-cylinder Buda Diesel engine. A direct-connected Diesel-engine-driven turbine pump unit, made by the Fairbanks-Morse Co., Chicago, Ill., was described in Rock Products, June 23. The gear unit in this pump consists of a cast-iron housing in which are located two bevel gear shafts, each of which carries a bevel gear to give the proper speed ratios. The bevel gear shafts are mounted in ball bearings and the vertical shaft which drives the pump is a hollow shaft of identical construction to that used on the line of UJL motors. A dredge pump unit powered by a Climax 85-hp. engine through a "Tex-rope" drive was decribed in Rock Products, March 3. This direct-connected unit is claimed to have delivered water at the rate of 1000 g.p.m., or 30 cu. yd. of solids to a maximum height of 60 ft.

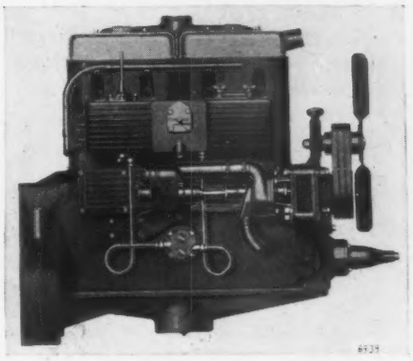


Fig. 82. One of new series of gasoline industrial motors

In the review of the crushed-stone industry elsewhere in this issue are given some operating data with oil engines as prime movers, driving electric generators. A number of notable installations were made during 1928, including a new large crushed-stone ballast plant in Canada.

Lime Plant Equipment

NOT much new appeared in the way of lime plant equipment in 1928, probably because the lime industry was not in a business condition to encourage effort on the part of machinery designers and builders.

Improvements were made in gas producers used in lime plants. R. D. Wood and Co., Philadelphia, Penn., brought out an entirely new producer, automatic in operation (Rock Products, July 7). The Wellman-Seaver-Morgan Co., Cleveland, Ohio, brought out a new type of mechanical fuel feed for producers (Rock Products, September 1). The Dover Boiler Works, New York City, began the marketing of a new type of gas producer.

The Hardinge Co., New York City, in cooperation with a prominent lime manufacturer worked out a satisfactory method of pulverizing burned lime—a problem that has puzzled several lime manufacturers and machinery builders alike. The Hardinge Co. has adapted its 7-ft. by 36-in. conical ball mill, equipped with a rotary air classifier, so that it is grinding 12½ tons per hour of 90% through 100-mesh, using minus 1-in. feed, it is claimed. The temperature of the lime entering the mill is 360 deg. F. in the case of a rotary kiln lime. The Hardinge method of air classification employs a system of reversed currents. By this method, it is claimed, fineness of any degree is secured and maintained constant under all conditions. The installation is illustrated in Fig. 71.

Arnold and Weigel, Woodville, Ohio, have improved their "Weber" hydrator. This firm is engaged as engineers in one of the most interesting experiments in the lime industry ever tried in this country—the burning of oyster shells to lime in a rotary kiln. The plant is under construction at Houston, Tex., for the W. H. Haden Co., and a brief description appears in this issue in the review of the lime industry.

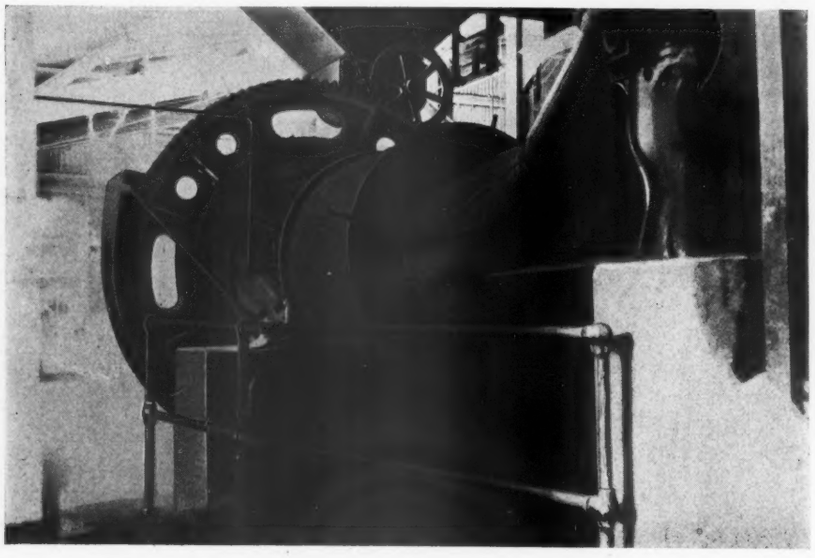


Fig. 71. Mill and air-classification unit especially designed for and adapted to pulverizing quicklime

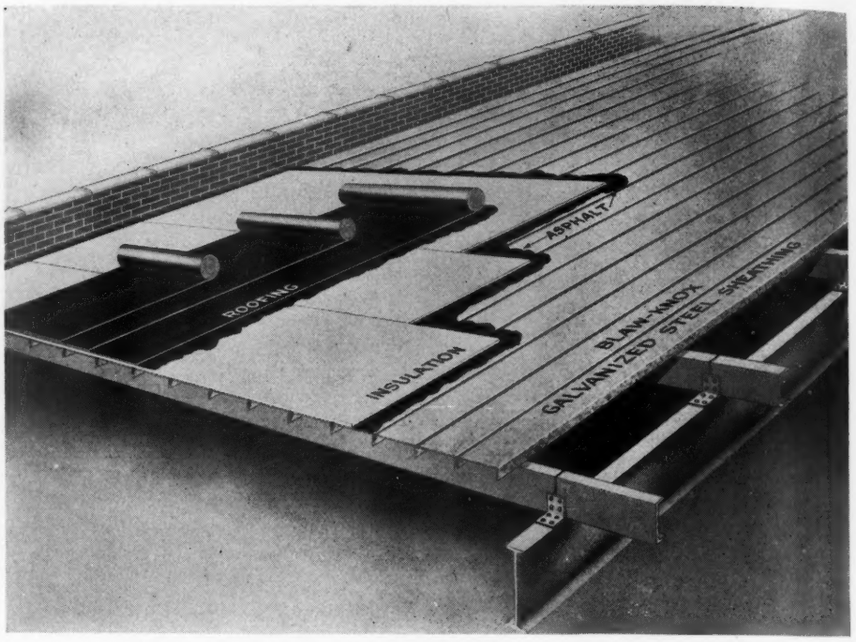


Fig. 72. New type of sheet-metal roofing

Bins, Bin Gates, Building Material

CONSIDERABLE engineering talent is finding its way into the design and fabrication of bins for sand, gravel and stone plants. In the review of the crushed-stone industry some steel bins at Worcester, Mass., belonging to the Connecticut Quarries Co., which were knocked down and reassembled without the loss of any part, are illustrated. These and bins for a gravel plant at Summit, N. J., illustrated in the review of the sand and gravel industry, were designed and fabricated by Davis and Averill, Inc., Newark, N. J., who specialize in steel service bins for various industries.

Equally interesting are the concrete-stave bins which the Neff and Fry Co., Camden, Ohio, specialize in, and which are illustrated in the section on the review of the sand and gravel industry, elsewhere in this issue. These bins have been erected in 1928 for the Hilltop Builders' Supply Co., North College Hill, Ohio; the Cinder Concrete Units Corp., Somerville, Mass.; the Chillicothe Sand and Gravel Co., Chillicothe, Ohio, and the Whiterock Quarries of Pleasant Gap, Penn. These bins or silos are made in diameters from 10 to 24 ft. The construction of these silo staves is especially interesting to aggregate producers because this company has made very exhaustive tests to find the best materials and the best gradation of materials for the strongest units, as well as the application of scientific knowledge in mixing and placing the concrete in the forms. The staves are plain concrete, not reinforced.

James B. Seaverns Co., Batavia, Ill., which has devoted considerable effort to bin design and construction in Chicago territory, has recently brought out a new 50-yd., type "R" bin. It can be assembled, practically, at the factory in one unit. The legs are shipped unbolted, also short knee braces. Knocked down, the bin is 10x15 ft., so that it can readily be loaded on a flat car. Erected, the bin is 21 ft. high, with a 9-ft. truck clearance. Provision is made for two 15x15-in Seaverns clamshell gates for the self-clearing bottom. Batch-measuring hoppers are provided when desired.

The Blaw-Knox Co., Pittsburgh, Penn., added to its line of bins, batchers and structural members by putting out a new "Blaw-steel" roof sheathing, illustrated in Fig. 72. It is designed for 65 lb. per sq. ft.

The Stephens-Adamson Manufacturing Co., Aurora, Ill., brought out a new bin gate, known as the "Moore" gate, described in Rock Products, August 18.

Cement-Mill Machinery

THE year 1928 has been a particularly notable one with manufacturers of cement-mill equipment. Keen competition, augmented this year by the latest equipment of European design, has driven manufacturers to develop many new labor-saving, maintenance-cost saving ideas.

The Vulcan Iron Works, Wilkes-Barre, Penn., announced a new design of single-roll bearings for all sizes of rotary kilns, coolers and dryers (Rock Products, January 21).

The Hill Clutch Machine and Foundry Co., Cleveland, Ohio, brought out a new tubular agitator for cement slurry (Rock Products, August 4).

Two new automatic continuous samplers, designed specifically for mining operations, but adaptable for use in sampling cement slurries were described in Rock Products, October 27.

The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., considers the most important development in cement kiln design and construction, the 11 ft. 6 in. by 15 ft. by 250 ft. kiln it made for the West Penn Cement Co., noted in our review of the portland cement industry elsewhere. The 15-ft. zone is the calcining zone and not the "burning" or sintering zone where clinker is made. The calcining zone is the zone of greatest heat requirement for driving for the CO_2 from the limestone, and for bringing the ingredients up to the sintering or clinkering temperature; heat is actually given off in the chemical reactions of sintering or clinkering. Hence the advantage of an enlarged calcining zone over an enlarged clinkering zone, for it permits the heat to be held where it is most needed. The experiment has been found not only to materially increase kiln capacity but has decreased fuel consumption and given a more uniformly burned and better clinker.

The Allis-Chalmers compeb mill construction and grinding arrangement has been improved (Figs 58 and 59). Summarized these improvements are claimed: (1) Simplified table and spout feeder arrangement; (2) correct peripheral speed for both ball and tube mill ends of mill obtained by the two different diameters; (3) tapered interconnecting section resulting in a classification of the balls and material in the primary grinding compartment; (4) large and effective peripheral screen which effects a closed-circuit on the first compartment; (5) possible application of a classifier or air separator in closed circuit with the second compartment, resulting in higher grinding efficiency for this stage and the production of a classified feed for the third compartment. With these improvements the manufacturer feels able to deliver a finely sized material to the last compartment of the mill with maximum efficiency, and in the last compartment produce slimes or "flour" necessary for high early strength cement, and to obtain these fines with good efficiency by means of a very small grinding medium, permissible on account of the uniformity in size of feed.

The first 8x42-ft. mill supported at one end by a tire carried on a two-roller carrying mechanism is claimed by the Allis-Chalmers company (installed at the Standard Portland Cement Co. plant, Painesville, Ohio). The feed end of this mill is supported on a tire carried on rollers running on tapered roller bearings. The discharge end is carried on a trunnion running on anti-friction tapered roller bearings. Welded steel construction has replaced castings in various elements of the new compeb mills, such as division head, main bearings and carrying-roller bases.

The Allis-Chalmers company has also made important improvements in rotary-cooler design, the outstanding one being made on a 9x90-ft. cooler. At the feed end of this cooler for a distance of approximately 9 ft. there is constructed a series of pockets, approximately 18-in. deep, radially around the shell. These pockets receive a spray and dip into a bath of water, which quenches the heat of the clinker as it drops into these pockets from the discharge end of the kiln The high heat of the clinker, which is so destructive to metal surfaces, being greatly dissipated in this section of the cooler, the clinker passes on to a section approximately 21 ft. long, which is lined with a special cast-iron lifter lining, to shower the clinker through the air passing the cooler. The remaining section of cooler is of steel plate diaphragm construction, which divides the clinker into four compartments. This cooler is claimed to be producing a thoroughly cooled clinker from which a very high grade cement is being made. Rapid cooling of the clinker is considered desirable both for its share in quality of product, and for improving the grindability of the clinker.

The Traylor Engineering and Manufacturing Co., Allentown, Penn., which more than a year ago began substituting support rollers for kilns, coolers and dryers of the single-roll type, has now gone a step further and has eliminated the roller shaft by extending the roller hubs to form stubs, and redesigned the bearing to employ Timken roller bearings mounted directly on the stubs of the roller hubs (Figs. 63 and 64). The outer race

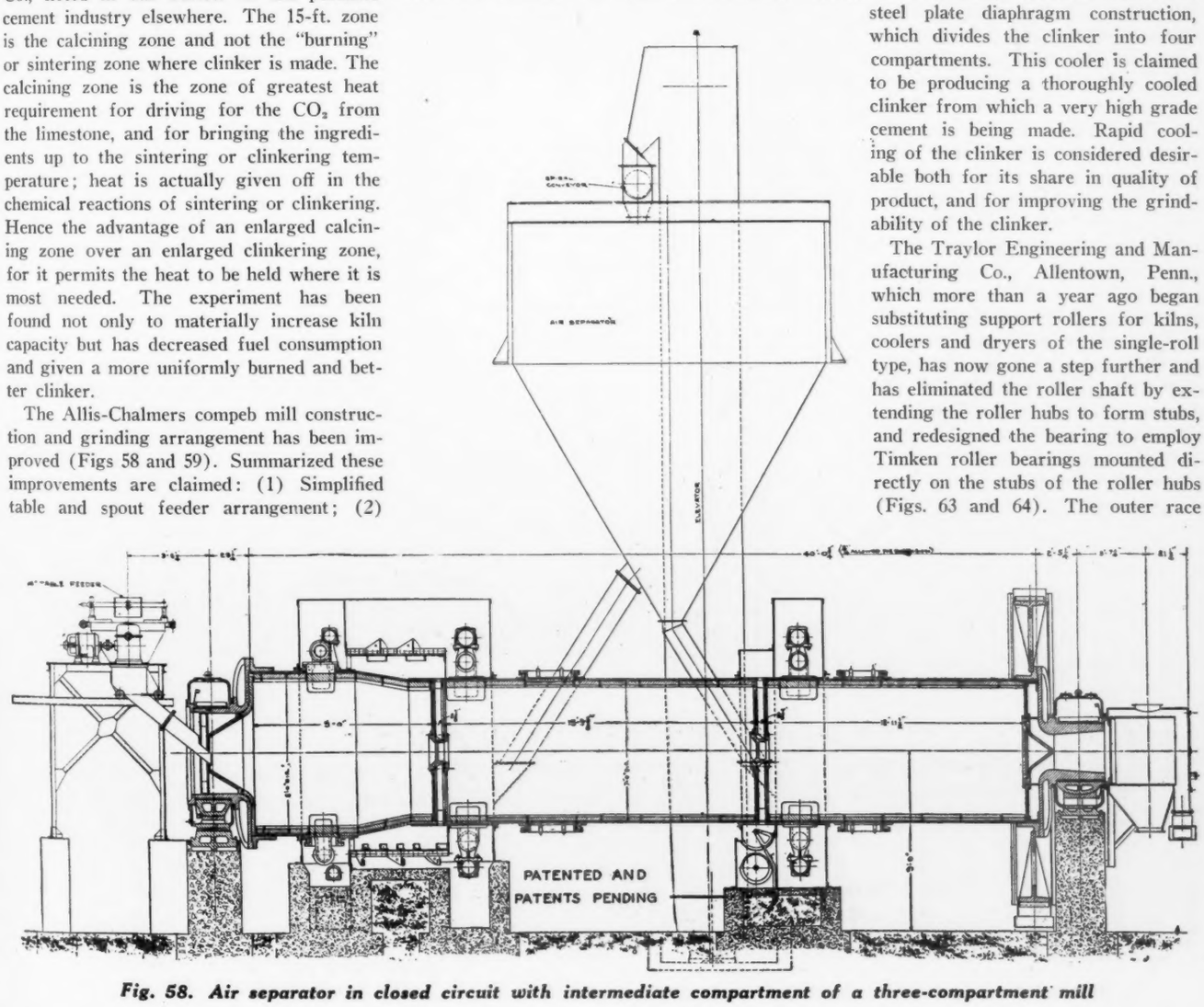


Fig. 58. Air separator in closed circuit with intermediate compartment of a three-compartment mill

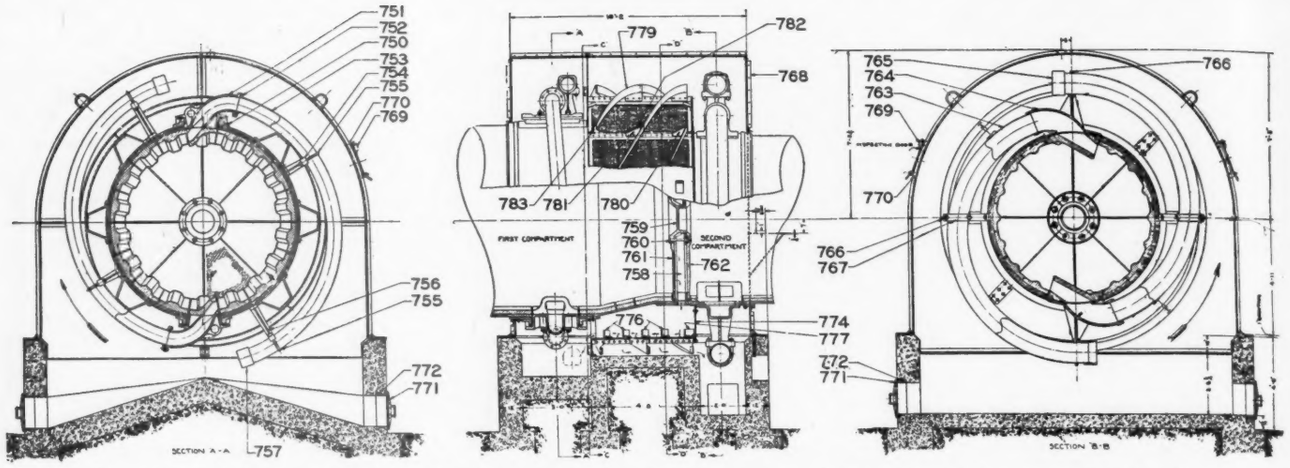


Fig. 59. Division head with peripheral screen aand return scoops for both wet and dry compartment mills

of Timken bearings is held in place by an adapter carefully machined for, and bolted to, the pedestal bearing, fitted with an inside cover and packed to render the bearing dust-proof and oil-tight. Alemite lubrication is standard, but the pedestal is designed with an oil chamber so that the Timken bearing may be operated in oil, if desired. In the case of the thrust bearing the rollers are made conical to operate without slippage. The shaft is made integral with the roller and is provided with a thrust button on the bottom. The roller brackets are bronze bushed, clamped together and bolted to the sole plate mounted on the roller frame. The roller brackets are adjustable laterally and vertically.

The Traylor company also announces the construction of the "largest" compartment mill—8x7x50 ft. (Fig. 60). The compartments are 12, 14 and 24 ft. respectively with Traylor patented partition and discharge diaphragms. The feed end is carried on a locomotive tire riding ring, shrunk into place on a cast-steel support, riveted to the shell, resting on two hard cast-steel rollers of large size. The rollers have Timken bearings. The discharge end of the mill has an accurately turned trunnion, and with extra heavy Timken bearings carries this end of the mill. These bearings are mounted in an extra heavy pedestal, secured in place by adapters, protected from grit and loss of lubricant by special sealing rings with labyrinth grooves and felt packing. The pedestal is of the ball-and-socket type, mounted on a heavy sole plate, which is wedge adjusted. A pump, cooler and filter are provided for supplying lubricant to the bearing—about 2 gal. of oil being required. The drive is of the single-reduction type, a high carbon steel girth gear with involute cut teeth meshing with a tool-steel pinion, both completely housed for dust-proofness, the lower part of the housing protecting the pinion, forming an oil reservoir, in which the pinion runs. The main countershaft has two Timken bearings, and two additional Timken bearings are provided for the shaft extension to the motor. The shaft extension is fitted with one flexible coupling and one solid coupling. The mill is fitted with an outside screen for returning oversize passing the partition diaphragm back to the coarse compartment, discharging the fines at the same time to the intermediate compartment through four ports in the diaphragm frame. The discharge trunnion is fitted with a conical screen, in a dust-proof housing, with separate discharges for finished product and broken balls, which may escape from the mill.

In order to meet the needs for manufacturing these new mills (and kilns, cooler and dryers) the Traylor company has introduced one of the most advanced types of gear-cutters on the market (Fig 61), which shows work on a cast-steel gear 14 ft. in diameter, with an 18-in. face.

Another new Traylor product is a table feeder (Fig. 62) especially designed to be oil-tight and dust-proof. The table is made with three seal rings, engaging rings cast integral with the housing to prevent dust from entering the driving-gear chamber. The top of the table is protected by a heavy, renewable steel wearing plate. The base casting is machined to receive the housing and in the bottom of the gear chamber is fitted a Timken bearing to receive the lower end of the table shaft and take its thrust. The table feeder is worm driven, the worm being integral with the shaft, extended to both ends, so that the feeder may be driven from either side (50 to 1 ratio) .There is a single scraper, ground on the bottom to fit the table, with screw adjustment. A telescopic steel feed pipe is used to regulate the feed, being provided with an operating lever, hand wheel and screw, and a stationary nozzle.

Fig. 60. An 8x7x50-ft. compartment mill

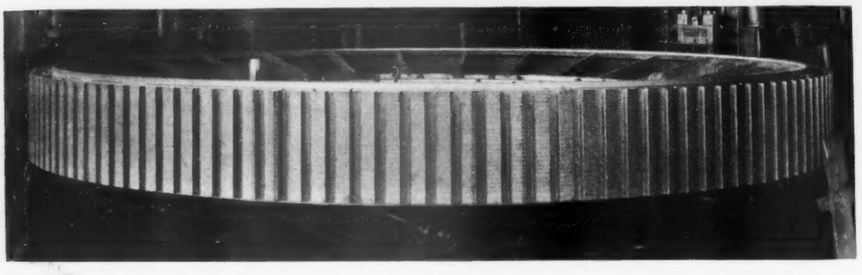


Fig. 61. Illustrating how gears of large kilns are accurately machined

The Fuller-Lehigh Co., Fullerton, Penn., states the Bailey coal feeder, first described in our annual issue a year ago, has now 42

installations on cement kilns. This company has recently placed on the market a new drag feeder (Figs. 65 and 66) for coarse materials. This feeder is driven by a variable-speed motor and is equipped with a levelling weight, which in connection with speed adjustment of the motor, regulates quantity and uniformity of feed. The operating range is from 2 to 20 tons per hour.

The Polysius Corp., Bethlehem, Penn., announces changes and improvements in its "Solo" compartment mills, the latest American examples of which are installed at the Keystone Portland Cement Co. plant, Bath, Penn. Special attention has been paid to the design of the partition between the first and second grinding compartments. This partition comprises a primary and secondary screening device, a section for returning oversize material to first or feed-end compartment, and a section for delivering screened material from the secondary screen to the second grinding compartment. The material crushed in the first compartment passes through slotted grid plates at the end of this compartment and enters a section between the grid plates and the first of a pair of transverse wall plates between which a horizontal drum and a cylindrical screen are mounted. The screen is placed midway between the horizontal drum and the shell of the tube mill. Circumferential scoops and radial arms attached to the grid plates lift and deflect the ground material to the interior horizontal drum, the far end of which is provided with rectangular openings through which the ground material passes to the secondary screen. The over-size material retained by the screen travels back toward the feed end of the secondary screening chamber, where scoops return it to the first compartment. The material passing the secondary screen is deflected to the section at the end of the screening chamber, from which it is delivered by means of the lifting action of the radial arms to the succeeding compartment.

The Polysius Corp. also announces a slurry dryer as an integral part of a cement kiln. This dryer or dewaterer comprises three sections built inside the kiln shell; these sections have a continuous length of about 25 ft. Referring to these sections as *A*, *B* and *C* their functions are as follows: *A* section is about 5 ft. long and consists of a single steel-plate partition with expansion joints, which divides the kiln into two semi-circular compartments. Inclined lifting shelves are provided to lift and shower the liquid slurry through the hot kiln gases; *B* section is the same length as *A* section but consists of two partitions, dividing the kiln into four quadrants, one of the partitions being in alignment with the one in *A* section. Their function is the same as in *A* section. The *C* section is about 15 ft. long. The cross-section of this part of the kiln is divided into eight parabolic compartments arranged around an octagonal core, concentric with the axis of the kiln. Four radial sides of these compartments are in alignment with the partitions in *B* section. The object of this construction is to break up the slurry into smaller volumes, cascade it through the hot kiln gases, and in the final compartment to roll the now relatively dry slurry into small balls or nodules.

A washer for waste gases from rotary coal dryers is another contribution of the Polysius Corp. This washer consists of two vertical spraying chambers, connected in series, one above the other, with a suction fan between the two chambers. The lower chamber is piped directly to the dryer stack housing, or to the smoke chamber. The dryer gases enter the lower chamber through a pipe that enters from below. This pipe is provided with a conical cap to deflect the gases and dust toward the cylindrical shell of washing chamber. Water nozzles above the cap of the smoke inlet pipe product a mist which fills the washing chamber and precipitates the dust to the bottom of the

Fig. 62. Table feeder for cement mills with special protection against entrance of dust

Fig. 63. Roll supports for kilns, coolers and dryers, equipped with roller bearings

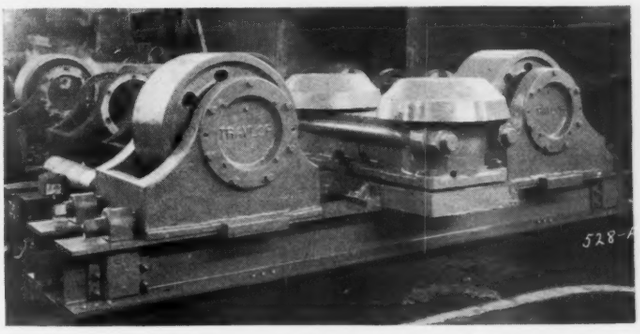


Fig. 64. Trust roll bearings for kilns, coolers and dryers

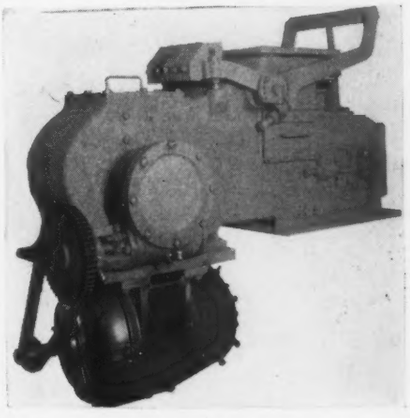


Fig. 65. A new feeder for coarse materials

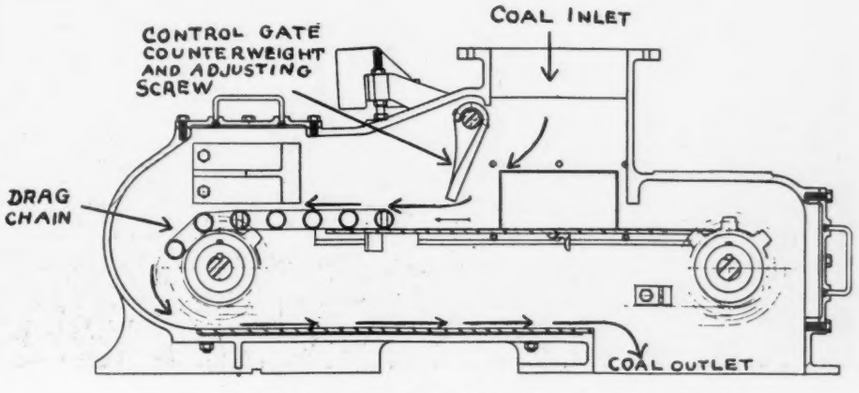


Fig. 66. Details of coarse material feeder shown in Fig. 65

chamber where it flows to a settling basin. The scrubbed gases leave through the top of the washing chamber and enter the suction fan, which discharges them to a second washing chamber, where the process is repeated.

The Polysius Corp.'s slurry pumps have been illustrated in previous issues of Rock Products, but never very accurately described. These pumps are called "Pressors" and consist of two parallel vertical receivers with individual compressed-air controls mounted above each receiver. These controls are interconnected and are actuated alternately by a ball float in each receiver. The slurry inlet and outlet pipes are at the bottoms of the respective receivers, which are tapered at this point to prevent the accumulation of inert matter. The flow of slurry from the double "Pressor" is continuous; while slurry is flowing by gravity into one receiver, which during the filling cycle is automatically disconnected from the compressed-air supply, it is being forced out of the other receiver by compressed air, which has been automatically admitted to that receiver. The alternate connection of the two receivers to the sources of slurry and compressed air are so synchronized that the flow of slurry from a pair of "Pressors" is continuous. The compressed-air control for each receiver is regulated by a pilot valve consisting of a balanced, cylindrical, two-way cock mounted above each receiver, admitting air to either of the two ends of a horizontal, companion, piston valve, which in turn opens or closes the air ducts leading to the receiver. While compressed air is being admitted to one receiver, the other receiver is automatically opened to the atmosphere. The slurry inlet and discharge pipes have rubber-jacketed ball valves. Slurry has to be fed to them by gravity.

The Richardson Scale Co., Clifton, N. J., has designed and perfected its method of proportioning cement materials by means of its "Convey-o-Weight" device. This device has been described in a previous issue of Rock Products. A recent installation at a cement plant is illustrated in Figs. 67 and 68. They are used to accurately proportion raw mixtures, so necessary in modern cement-mill practice. The views shown are installations at the Prospect Hill, Mo., plant of the Missouri Portland Cement Co., and at one of the Marquette Cement Manufacturing Co.'s plants.

The Advance Foundry Co., Dayton, Ohio, has developed a clinker chute of Strenes metal. The first installation was a chute made in two sections and bolted together in the middle. Fire brick were then laid over the metal. This installation lasted 73 days of continuous operation, then had to be renewed only because the bolts holding the two sections together had loosened and allowed the brick to work its way through, permitting the hot clinker to come in contact with the bare metal. On replacing the installation the Strenes metal casting was made in one piece, as shown in Figs. 69 and 70, and it is still in use; expected to give five or six times the service of the original installation.

The Bradley Pulverizer Co., Allentown, Penn., reports a number of improvements in the Bradley "Hercules" mill, and many new installations. This company also announces a new pneumatic pulverizer, or air-separator mill, which has already had a two-year tryout on both lime and gypsum This mill is

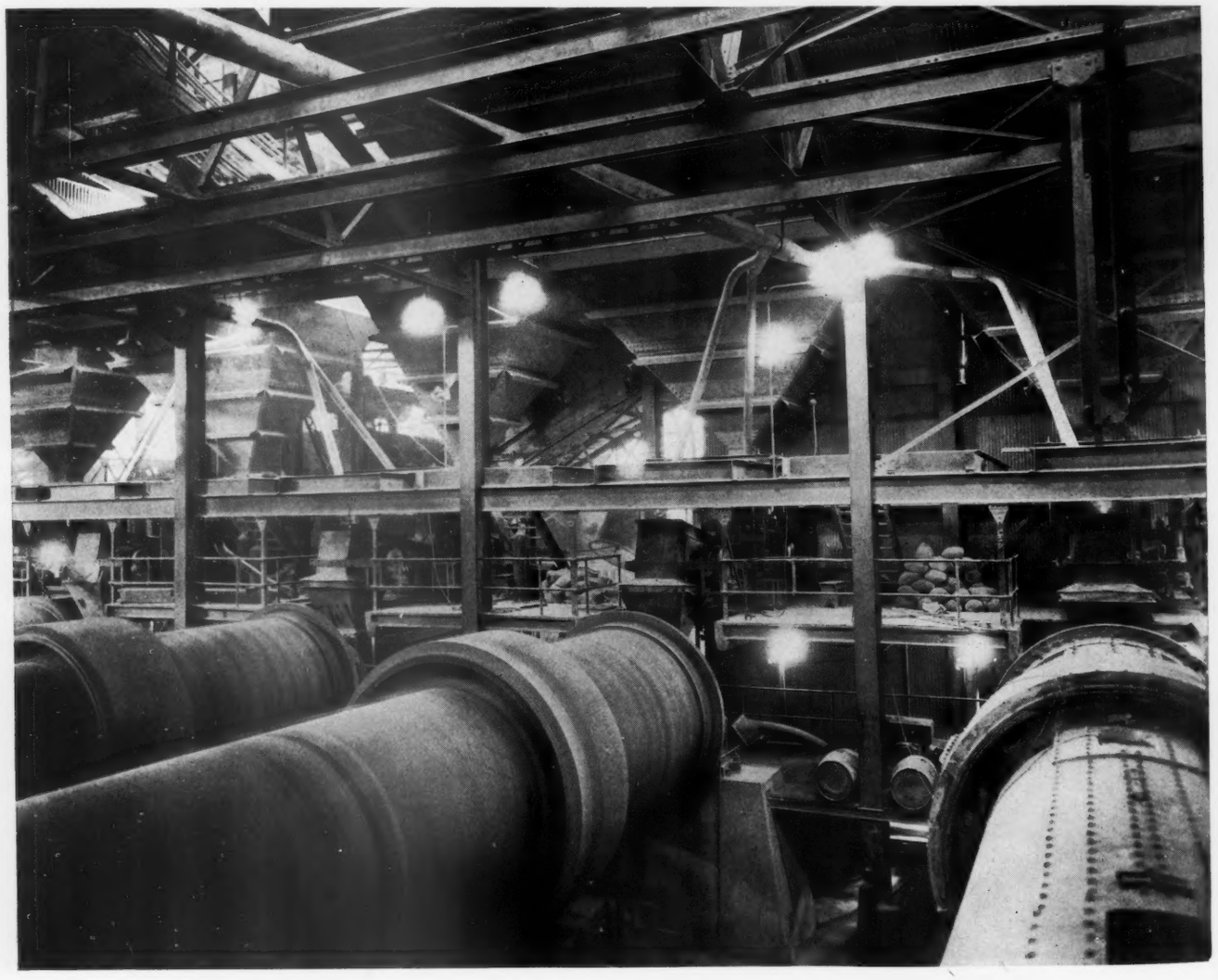


Fig. 67. Recent installation of automatic proportioning device for cement manufacture

built practically entirely with all roller bearings and has a capacity ranging from 8 to 12 tons per hour.

F. L. Smidth and Co., New York City, report one of the busiest years in their history. Notable installations made or completed during the year were at the Monolith Portland Midwest Co.'s plant, near Laramie, Wyo.; the Missouri Portland Cement Co.'s new "Velo" plant, St. Louis, Mo.; the changing over of the Canada Cement Co.'s Winnipeg, Man., plant from dry to wet process; the Ash Grove Lime and Portland Cement Co., Louisville, Neb., and the Volunteer Portland Cement Co., Knoxville, Tenn.

The Fuller Co., Catasauqua, Penn., has now installed its Fuller-Kinyon dry blending system at eight cement mills. This system has been fully described in previous issues of Rock Products, the most interesting perhaps being the installation at the new Colorado Portland Cement Co's. plant at Boettcher, Colo (Rock Products, June 23, 1928). An isometric drawing of this installation is shown herewith. The most elaborate installation to date is at the plant of the Crescent Portland Cement Co., Wampum, Penn., which is illustrated in the accompanying views. This installation comprises essentially of four blending silos and a small silo for storage of flue dust. Withdrawals from the five silos are made by individual Fuller-Kinyon pumps, and the pumps below the blending silos take care of the kiln deliveries as well as circulation for mixing purposes. The withdrawals from the silos are combined by discharging the first two and the second two pumps into a common line having branches leading to the kiln-bin transport line, and with the main lines returning the material to the silos in intermittent sequence.

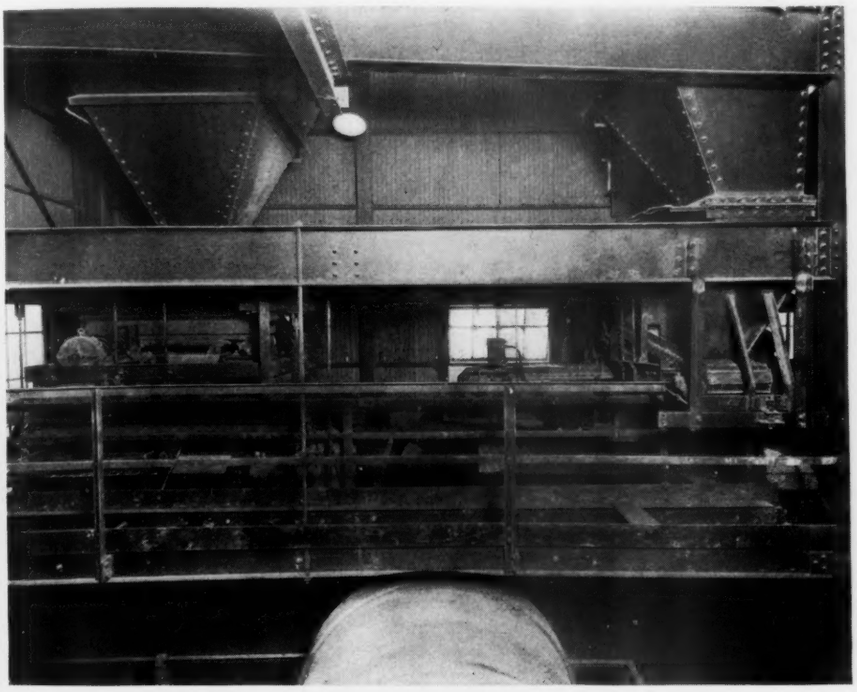


Fig. 68. Close-up of another installation for proportioning cement ingredients

The valves of the four transport lines above the blending silos are synchronized so that deliveries are made into the same bin at the same time from all systems. The actual cycle of operation is arranged to make deliveries at two minute intervals beginning with the first silo. During the first two minutes the mill stream, flue dust, and the withdrawals from Nos. 1 and 2 silos are directed into No. 1 silo. During this same interval deliveries are made to the first four kiln bins for one-half minute each. During the next two minute interval, the materials are diverted into No. 2 silo and kiln deliveries from Nos. 3 and 4 silos are diverted to kiln bins Nos. 5 and 6, then Nos. 1 and 2. For the next three intervals no deliveries are made to the kiln bins, but all materials are circulated in direct sequence Following this, deliveries to the kilns are made from the other two blending silos.

This blending cycle is more or less arbitrary and arranged to meet a specific plant condition. Without actually modifying the equipment, many variations can be made. The most important factors which minimize the composition error at this plant are (1) the intermittent delivery of the mill stream in continuous sequence to the four blending silos to distribute the error variation over the four bins; (2) the similar delivery of flue dust as it accumulates; (3) the formation of thin flat layers in the silos and the combination of the withdrawals due to the rat-holing effect of several spouts and the combination of materials by discharging into the same transport line; (4) the simultaneous delivery of all streams into the same bin at the same time under turbulent conditions; (5) the alternate kiln bin delivery at spaced intervals from the first two and the second two silos, and the delivery to the kiln bins at short intervals to form thin layers, which will run together as the kilns are fed.

The system is so arranged that the kiln deliveries are considerably in excess of the kiln requirements in order to insure continuous operation. If the system is set to make deliveries to the kiln bins at an interval when the bins are full, high level indicators automatically change the sequence so that all materials are placed in circulation in storage.

At one or two plants where the error variation was uniform, excellent results were obtained without arranging for circulation. These systems depend upon the alternate distribution to form the thin layers of tube mill product and the combining of these layers during withdrawal and delivery to the kiln bins. In these installations, however, more than four bins were provided to increase the error reduction.

At the Crescent plant the error of variation in the cement clinker is held within ½ of 1% either way; the tensile strength of the cement has been increased a minimum of 10%; the actual kiln output has been increased 10%, and there has been a noticeable decrease in coal consumption, but figures are not yet available on the amount.

For those who may be unfamiliar with the Fuller-Kinyon system of dry-blending cement raw materials it may be added that, in brief, the method consists generally in depositing thin layers of materials at pre-

Fig. 69. Special alloy chute for hot cement clinker

Fig. 70. Special alloy chute for hot cement clinker

determined time intervals in four or more blending silos. The composition of these layers includes mill stream, circulated material from each of the silos, and frequently a small quantity of flue dust if the latter is available. These layers are continuously deposited in a definite sequence, so that the composition in the tanks is substantially the same throughout.

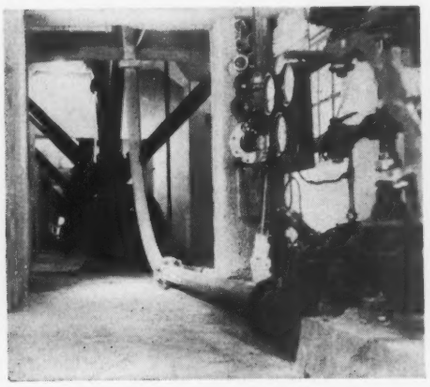


Fig. 71. Blending silo basement at Crescent Portland Cement Co. plant; flust-dust pump at right

In the formation of individual layers, the various materials entering the silo at the same time are partially mixed by turbulence, and when withdrawn through a plurality of spouts from each bin, mixing takes place due to the running together of the layers in the pipes or rat-holes formed above the spouts.

A careful consideration of the results obtained to date indicates that the two most important factors contributing to accurate kiln feed are, first, the distribution of the mill stream to the blending silos for short intervals of predetermined time and in continuous sequence to distribute the error variation over the number of silos available, and, second, the circulation of these layers in storage at a rate at least equal and preferably twice the requirement of the kilns.

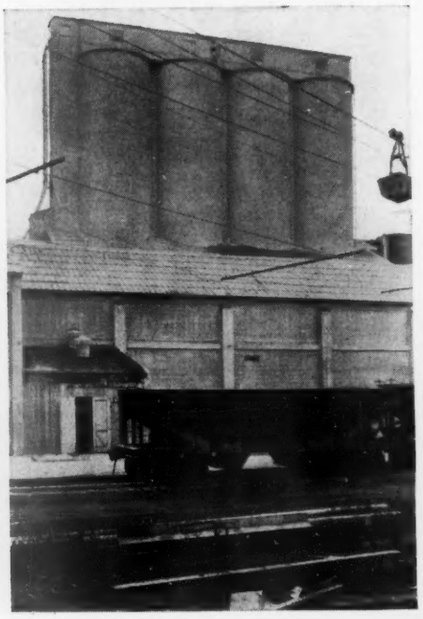


Fig. 73. Blending silos of the Crescent Portland Cement Co.

In designing these systems no attempt has been made to follow wet practice, but to take advantage of the peculiar behavior of aerated pulverized materials and the tendency of dry pulverized materials to discharge from bins in the form of pipes or rat-holes. There has also been no necessity for disturbing existing practices in obtaining the preliminary mixture of the raw materials prior to final grinding.

The usual installation includes Fuller-Kinyon systems for handling the mill stream, flue dust, circulating load, and kiln delivery. These several systems function as a single unit and are operated under timed automatic and remote control from a master panel located at any convenient point at the plant. Under normal operating conditions the automatic control takes care of the process, but to meet unusual conditions remote-control, push buttons and a time-interval control permit the chemist to modify the operation to take care of emergencies.

This system of raw mixing and transport is as adaptable to old dry-press plants as to new ones. One new plant, especially designed to utilize the Fuller-Kinyon system from the start, is that now nearly completed for the Marquette Cement Manufacturing Co., at Oglesby, Ill.

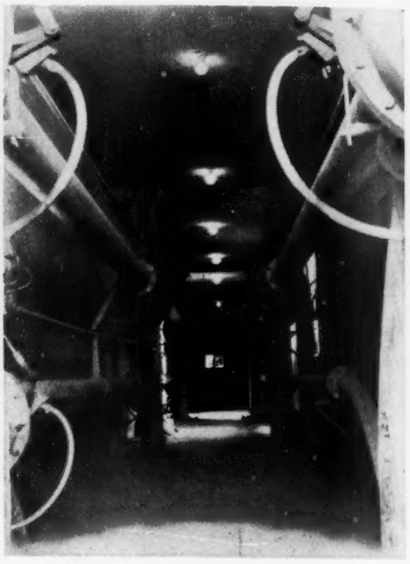


Fig. 74. The monitor above the four blending silos at the Crescent Portland Cement Co. plant—four independent conveying systems

New Steel Lime Container

THE Pittsburgh Steel Drum Co., Pittsburgh, Penn., has developed and put on the market in 1928 a full-removable head container on which the company states it has been working for four years. The container is so tight that it may be used for liquid shipments, as well as for lime and similar commodities.

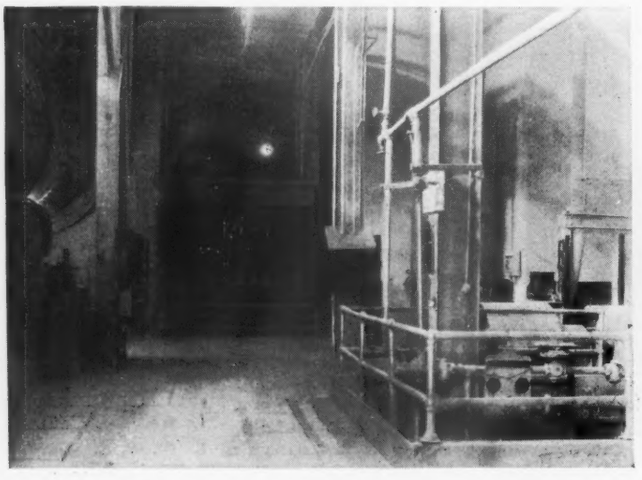


Fig. 72. Kiln room of the Crescent Portland Cement Co., showing control panel and 10-in. mill-stream pumps, and one of the two risers from blending silos

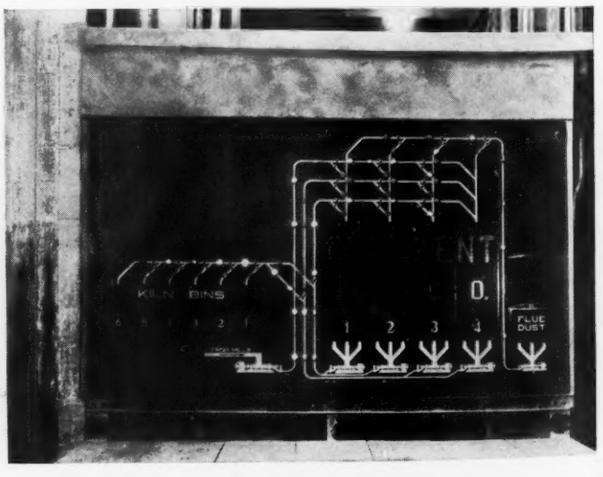
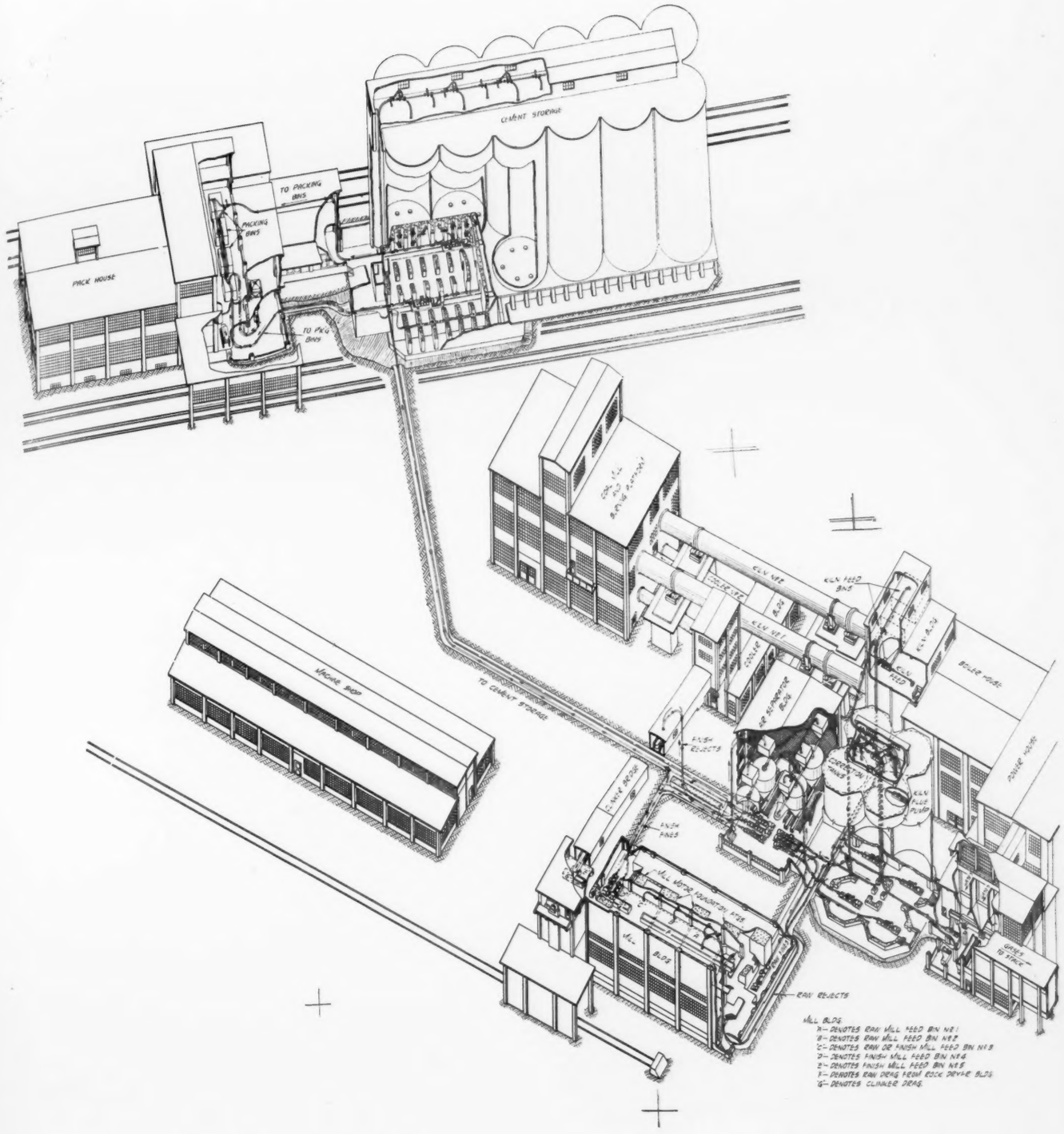


Fig. 75. Master control and signal panel operating the blending system at the plant of the Crescent Portland Cement Co.



Isometric drawing of the plant of the Colorado Portland Cement Co., Boettcher, Colo., showing air transports for raw materials and cement blending system. The red line shows the finished cement pipe line, the green line shows the raw material pipe lines

Alloys

THE American Manganese Steel Co., Chicago, Ill., made available many new parts of rock products machinery and equipment, including specially designed crawler parts for cranes, tractors, shovels, excavators, etc. (ROCK PRODUCTS, May 26). In addition to these this company announces other new parts shown in Figs. 116-120. These include

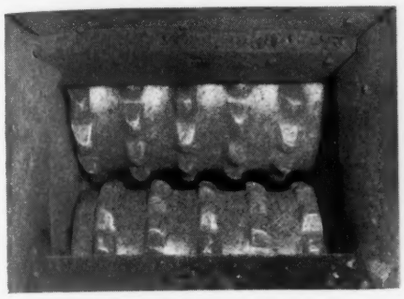


Fig. 116. Manganese-steel rolls for slag crushing

Fig. 117. Special manganese-steel crusher rolls

slugger-roll shells for crushing slag (Fig. 116); special toothed roll shells (Fig. 117); mine-car wheels (Fig. 118), and an all-manganese-steel, orange-peel bucket (Figs. 119 and 120) made with both three and four blades.

The Bethlehem Steel Co., Bethlehem, Penn., has developed a special steel coating for castings known as "Stainless-Clad." Either carbon steel or alloy steel is used as the base metal of the casting, depending on the requirements of the service for which it is intended. The coating is an integral part of the casting, covering only those surfaces which require heat resistance, and resistance, or exceptional wearing qualities. The stainless coating is amalgamated with the base metal. Typical castings with this coating are illustrated in Figs. 121 to 123.

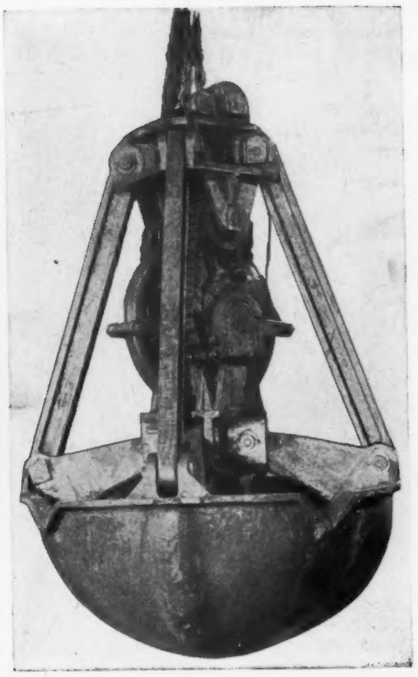


Fig. 119. All manganese-steel orange-peel bucket

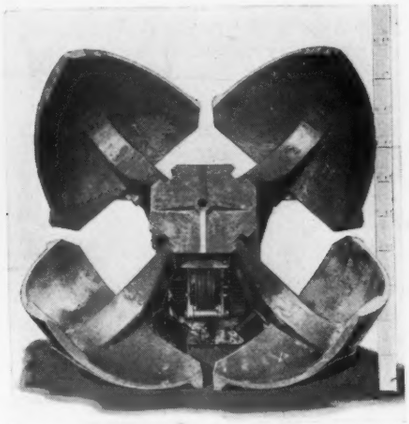


Fig. 120. Bucket from below

The General Electric Co., Schenectady, N. Y., developed a new tool material "Carboloy," which so far as we know has not yet been used in the rock products industry, but may yet. It is composed of tungsten carbide and cobalt, and very hard and strong, especially designed for cutting tools.

The Stoody Co., Whittier, Calif., brought out a new iron alloy "Stoodite" for hardening surfaces and edges of dipper teeth, etc. (ROCK PRODUCTS, February 4).

Cutting and Welding

A CONSIDERABLE amount of new equipment for cutting and welding, both oxyacetylene and electric-arc, made its appearance in 1928.

The Lincoln Electric Co., Cleveland, Ohio, brought out a new line of "dipped" welding rods (ROCK PRODUCTS, January 7), a butt welding machine (ROCK PRODUCTS, March 3), and a "Stable-Arc" welder, self-contained (ROCK PRODUCTS, May 12). The Oxweld Acetylene Co., New York City, produced an improved cutting blowpipe (ROCK PRODUCTS, February 4); and a new two-wheele truck for acetylene welding and cutting equipment (ROCK PRODUCTS, February 18); and three new welding outfits (ROCK PRODUCTS, March 17). The General Electric Co., Schenectady, N. Y., produuced a combination tractor and electric-arc welder (ROCK PRODUCTS, April 14).

The Alexander Milburn Co., Baltimore, Md., announced a new combination cutting and welding torch (ROCK PRODUCTS, and a regulator for gas pressure (ROCK PRODUCTS, June 23), and a regulator for gas pressure (ROCK PRODUCTS, November 10). The Westinghouse Electric and Manufacturing Co. put out a new 200-amp. portable electric-arc welder (ROCK PRODUCTS, July 21).

The Air Reduction Sales Co., New York City, brought out a new line of oxyacetylene cutting and welding torches, known as the "Airco Davis-Bournoville."

The Oxweld Acetylene Co. also placed on the market a new line of pressure-type acetylene generators (Fig. 124). Several features of the new design are said to improve the operation and further insure safety. The feed mechanism has been redesigned to make the carbide shutoff more positive. A new method is used to stop the carbide feed posi-

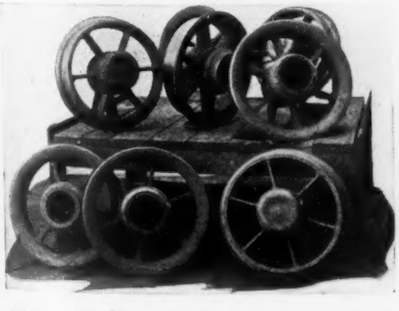


Fig. 118. Manganese-steel car wheels

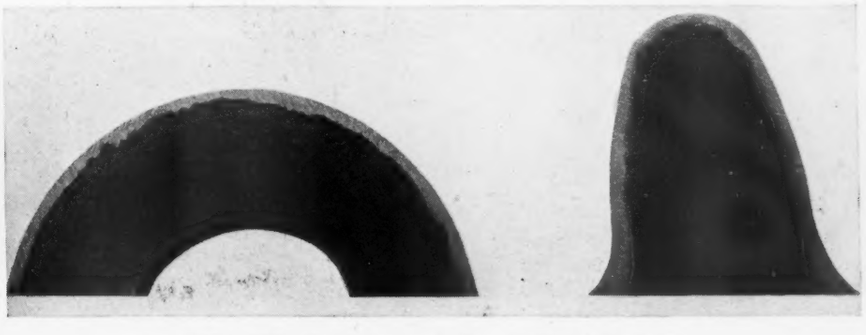


Fig. 121. New non-corrosive coating for steel

tively in case the diaphragm breaks or zero pressure exists in the generator from any cause. A new regulator of the stem type is provided. The hydraulic back-pressure valve, which has been simplified and the filter are of seamless steel tubing assembled by bronze-welding and then galvanized. The vertical pipe, leading downward to the back-pressure valve and extending below the surface of the water, is fitted with an angle valve. In case back pressure is exerted, water will be forced up the vertical pipe causing the check valve to close, preventing the possibility of back pressure or flash reaching the interior of the generator. Many other special features are claimed.

Fig. 122. (Right) Hammer-mill hammer castings treated

Fig. 123. (Left) Dipper teeth of specially coated steel

This company has also added to its line of accessories the cap and skeleton type helmet goggles illustrated in Figs. 125 and 126, which are claimed to be comfortable and convenient and insure full protection to the operator.

Fluorspar in 1928

THE PRODUCTION of fluorspar for the past five years was:

Year	Tons	Value	Value per ton
1923	121,188	$2,505,819	$20.60
1924	124,979	2,451,131	19.60
1925	113,669	2,052,342	17.75
1926	128,657	2,341,277	18.30
1927	112,546	2,034,728	18.15

The production for 1927 was confined to the states of Kentucky (57,495 tons), Illinois (46,006 tons), Colorado (6432 tons) and New Mexico (2613 tons).

The use of this mineral is divided among the following industries in the percentages indicated:

Steel	82.0%
Glass	5.7
Foundry	4.7
Enamel ware and sanitary ware	2.6
Hydrofluoric acid	2.7
Miscellaneous	0.3
Exported	2.0
	100.0

In the steel industry the fluorspar is used as a flux, principally in the basic open hearth process, and is added to give fluidity to the slag. The mineral is used in foundry practices for the same reason. Fluorspar is used in the glass industry in connection with the manufacture of opal, opaque and colored glasses; in enamel ware it is used as an ingredient for enamels, for coating plumbing fixtures, kitchen ware, tubs, etc.

Fluorspar has been used to a limited extent in the cement industry and when added to the kiln feed gives a lower fusion temperature to the clinker.

For production of hydrofluoric acid (HF), calcium fluoride is treated with sulphuric acid, thus generating gaseous HF, which, after absorption in water, is used for two commercial products, namely, manufacture of artificial cryolite and hydrofluosilicic acid. The first substance (Na_3AlF_6) is made by treating bauxite (hydrous aluminum oxide) with the hydrofluoric acid.

Hydrofluosilicic acid is made by treating finely ground silica sands with hydrofluoric acid in suitable lead-lined leaching towers. The resulting acid is used as an electrolyte for electrolytic refining of lead. One plant at Omaha, Neb., uses several carloads of both fluorspar and silica per year for the purpose.

One Canadian company incorporated during the year 1928 at Toronto and was capitalized at $40,000.

Fig. 124. Acetylene generator

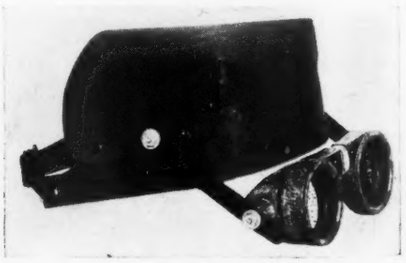


Fig. 125. Welding cap

Fig. 126. Welding goggles

Cement Products Equipment

ALTHOUGH the past year has not been marked by any considerable activity in most types of cement products equipment, there is apparently quite a few new items in the field of conveying trucks, for ready-mixed concrete and concrete mixing trucks. Early in the year, the Clinton Motors Corp., Reading, Penn., announced a new 3-yd. truck, with a rotating body for carrying concrete from central mixing plants to construction jobs (Rock Products, February 18). Late in the year the same company announced a 2-yd. truck, identical in design with the larger truck, which will be used for smaller jobs and speedier work. The new unit is mounted on an entirely new 3-ton Clinton chassis of 154-in. wheelbase. This chassis is equipped with unit power plant consisting of a six-cylinder engine developing 74 hp. at 2400 r.p.m., and is equipped with a transmission having four speeds forward and one reverse. The Good Roads Machinery Co., Kennett Square, Penn., has announced that it will manufacture similar units on Clinton chassis and will distribute them over territory not reserved for the Clinton company's distribution.

A second truck unit which was recently announced, was that of the Blaw-Knox Co., of Pittsburgh. This unit is made in capacities of 1, 2 and 3 yd., and is fitted with revolving blades to keep the mix agitated while in transit. The unusual feature of this truck is that the body may be raised to a height of 7 ft. 6 in. from the roadbed for dumping to a chute or hopper, by means of a special elevating device. The body may also be tilted and dumped from its normal position without extending the special elevating device, when it is desired to dump for regular work such as street or road construction.

A new non-elevating type of truck concrete mixer was announced by the American Truck Mixer Corp., of San Francisco (Rock Products, December 8).

In equipment for products plants, the Consolidated Concrete Machinery Corp., Adrian, Mich., has brought out a new mixer with a number of interesting features (Fig. 127). These new "Ideal" mixers are made in sizes of from 9 cu. ft. to 42 cu. ft. They have shorter, deeper drums, and larger discharge doors for prompt and complete discharge of the batch. The units come equipped with either paddles or a spiral blade protected by "Strenes" metal wearing plates. The shaft is round, with milled seats for clamping the paddle arms rigidly in place. The mixers have a special feature of removable "Strenes" metal plates in the drum heads, which divert the wear to the spring collars on the shaft, so there is no wear on the drum heads at these points.

The Consolidated Cement Machinery Corp. have also sent two representative sample layouts for concrete products plants (Figs. 128 and 129). These are examples of what the company's engineers are now doing to assist in designing plants for producers of concrete products. This design service is free and is maintained as an aid and convenience for products manufacturers.

Developments in the concrete products industry have been steady but not startling during 1928, and there has been little equipment brought on the market which is essentially new. On the other hand, the allied field of ready-mixed concrete delivery is new and has only been getting a good start during the past year. The various types of trucks brought on the market give evidence that this field is rapidly becoming of real importance.

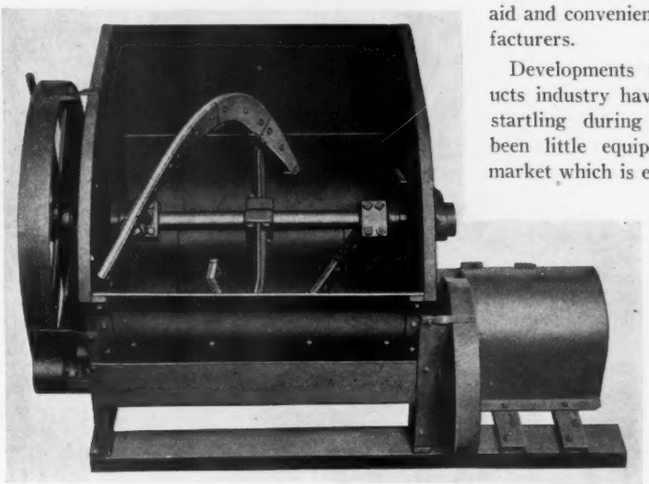


Fig. 127. New mixer has several interesting features

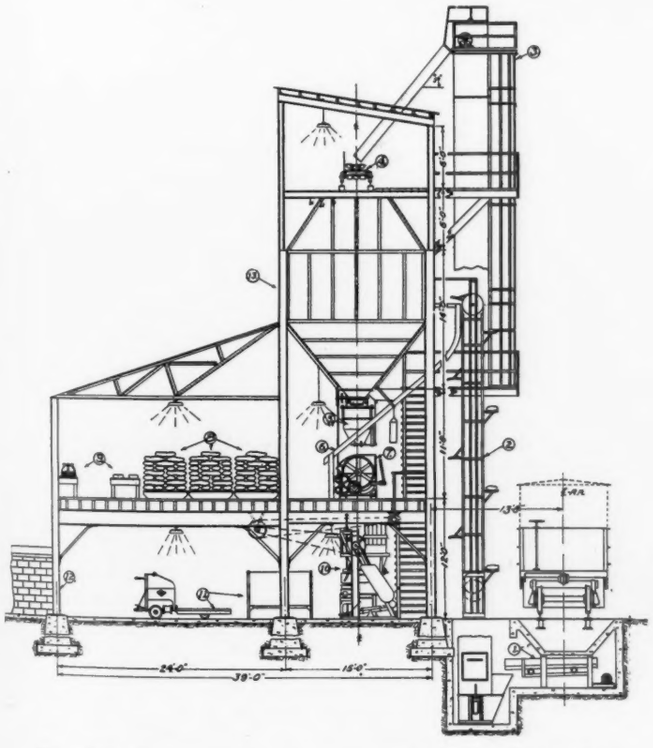


Fig. 128. Cross-section of a representative products plant using lift trucks for handling the products

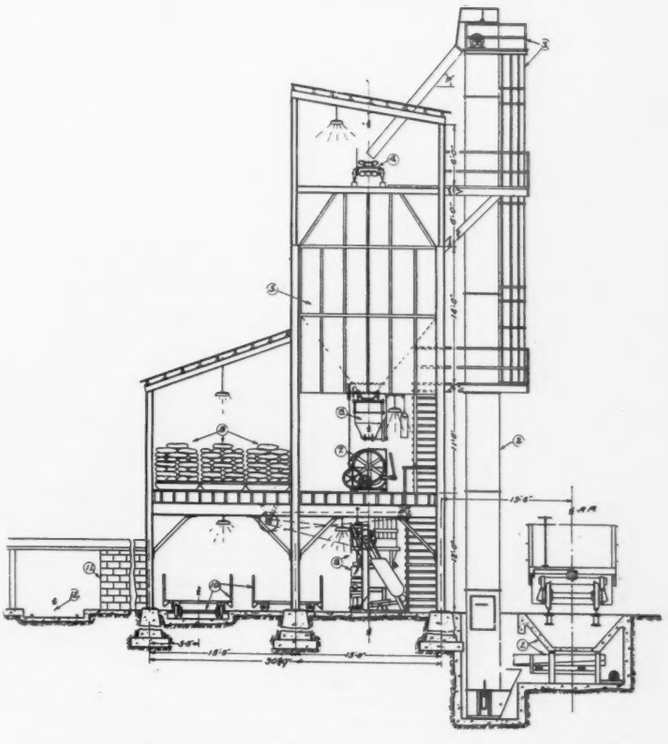


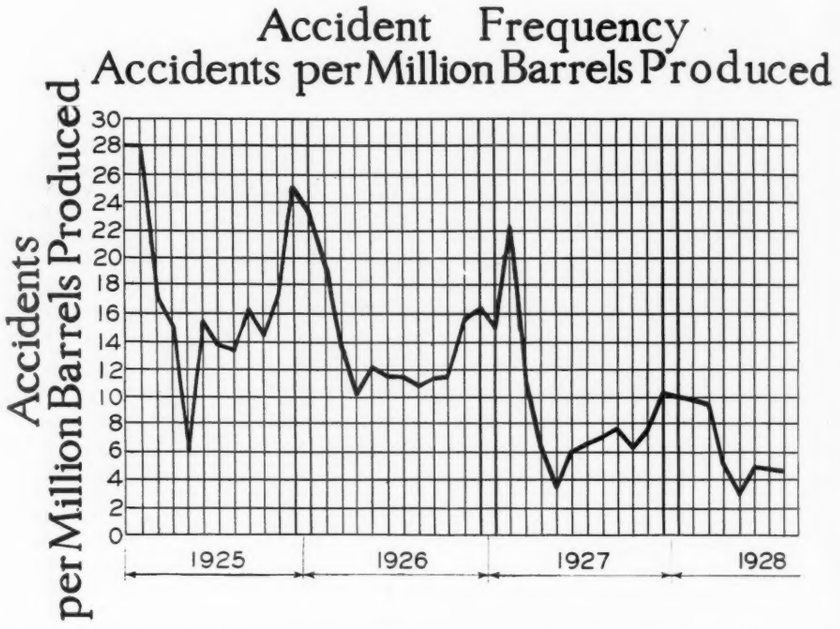
Fig. 129. Sectional view of a representative cement products plant in which the products are handled by kiln cars

Accident Prevention in the Cement Mills During 1928

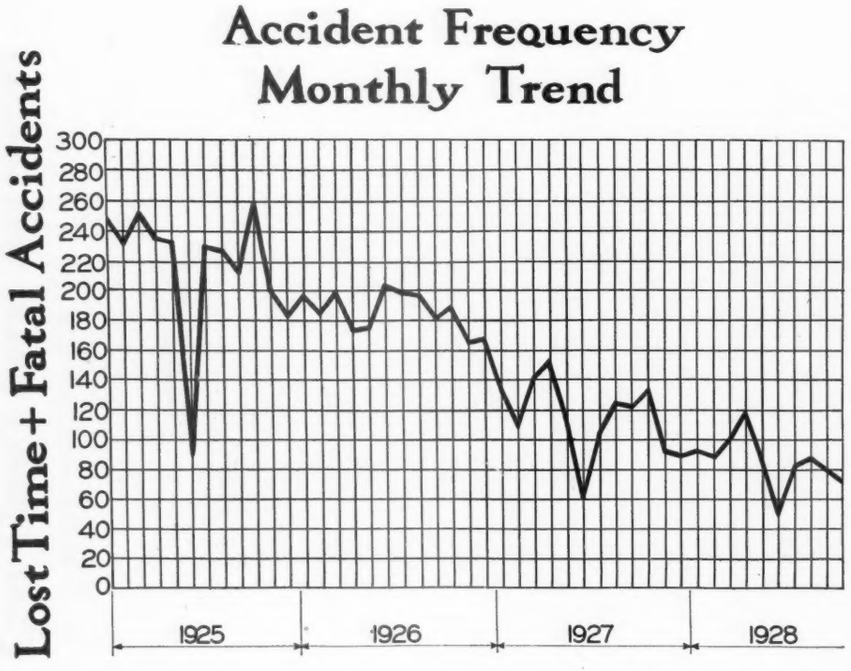
By J. B. John
Chairman, Committee on Accident Prevention and Insurance, Portland Cement Association

PROGRESS of accident prevention work in the cement industry during 1928 was encouraging. After the record-breaking experience of 1927 many of us had grave doubts as to whether last year's record could be equaled, much less surpassed, in 1928. But with the end of the year only a short distance ahead, and many of the mills already closed down for the winter, it is now quite apparent that we will have made more cement with fewer accidents this year than ever before. When I say "we" I mean, of course, the mills of the Portland Cement Association members in both the United States and Canada.

Have you studied accident prevention as it relates to mills and factories? If so, you have learned how much patient work is required for even the most meager improvement. In the mills where I worked for many years at almost every job shown on the payroll, we were often discouraged to a point where few men believed accidents could be cut down to any great extent. Under those conditions even a slight improvement in our records would have surprised us and helped restore our faith. But now things are quite different. For example, I find that cement mills of the Portland Cement Association membership had considerably fewer accidents during the last three months than during the average month of 1924.



Curve showing the decrease in accident frequency per million barrels of cement produced from January, 1925, to August, 1928



Curve showing the decreasing frequency of the total accidents each month from January, 1925, to October, 1928

In 1928 a workman works three months with less risk of accident than if he worked one month in 1924. Our average monthly accident was 217 for 1925, 185 for 1926, and 114 for 1927, as against 87 for the first ten months of 1928, and we are now engaged, desperately, in driving down that rate to a still lower figure by striving to avoid all accidents during the remaining days of the year.

What this very great reduction means in terms of the balance sheet may be surmised from the fact that where there were over 28 lost-time accidents per millions barrels of cement manufactured in January, 1925, there were less than five such accidents per million barrels manufactured in September, 1928, and only 2.8 per million, the minimum yet reached, during June of this year. The financial savings inferred by these figures is of benefit to workers, investors and users. Everybody gains, nobody loses.

The monthly accident record of the reporting mills is shown in the accompanying tabulation and curves. The figures shown represent the total of lost time and fatal mishaps. The reporting mills have increased in number from 118 to 150 during the period covered by this table, for which no correction has been made. For example, there were actually 82 accidents within the 150 reporting plants in September, 1928, as against 125 accidents in 118 plants in September, 1925. But, had there been the present number of mills in 1925, there would have been approximately 273 accidents that month, judging by the accident rate per plant at that time. Reducing accidents from the equivalent of 273 per month to 82 per month in three years is real progress.

ROCK PRODUCTS recently printed the list of mills which have operated without accident thus far this year. At present there are still 20 which have made this enviable record, so we expect to award the Portland Cement Association trophy to very nearly that number for completing 1928 without injury or death to a single workman. Now think what that means. In the years preceding 1927 a total of four mills won trophies for perfect records. In 1927, ten mills, two and a half times the preceding total, won trophies. In 1928 we expect to award more trophies than all preceding years put together, and if we can, to double the number awarded amidst so much astonishment one year ago. It looks as though nearly one-eighth of all the operating mills in the United States and Canada would complete the year without lost-time or fatal accident.

Our experience in dealing with accidents has been quite unusual. It has even seemed to demonstrate lately that with but few reservations accident totals in our industry may be reduced to whatever we really want to make them. By no means have we reached the limit. While even the most obstinate cases have shown improvement, the unreasonable spread in accident frequency between certain mills is indicated by the fact that the mill with the greatest number of accidents in six months of 1928 had as many as all of the 72 best mills on the list put together. We must not be content while this sort of a record is possible.

Work Ahead

There is plenty of work ahead. An aggressive campaign to keep on reducing accidents, no matter how small the number which remain, is the soundest kind of insurance against an increase in accidents. It must not be forgotten that while we are on the aggressive we are also always on the defensive as well.

The Committee on Accident Prevention and Insurance of the Portland Cement Association, at its recent annual meeting, decided on an extensive program for 1929. The annual trophy contest is to be repeated and a trophy awarded to every cement mill in the membership of the association which completes the year 1929 without accident. The association would be happy to distribute $50,000 worth of trophies.

During June (and the months preceding and following) another June no-accident campaign will be held in which we hope every man in the industry, from the executives on down, will participate fully. The 1929 campaign will have many new features. During the period of two or three months preceding June the committee is inviting our membership to go into intensive first aid training, and the United States Bureau of Mines is placing its organization at our disposal for that purpose. Many mills are sure to respond. Our aim is to be a 100% trained industry.

As a result of the very successful series of twelve regional safety meetings held throughout the country in 1928, next year's schedule has been increased to fourteen meetings, covering all of the regions reached this year and two additional—Utah and the North Pacific states. The location and dates for most of these meetings will be announced in the near future.

The Portland Cement Association and particularly the members of its Committee on Accident Prevention anticipate with a great deal of pleasure the many great celebrations in prospect during 1929 at the mills which win the safety trophy for 1928. Many thousands of employes, loyal citizens, school children, and persons of national and local prominence will undoubtedly be on hand at the great celebrations which mark the unveiling ceremonies. Outside of the serious significance of these occasions, they are memorable for their feasts, athletic tournaments, ball games, entertainment and oratory. One mill even celebrated with a grand ball.

These events mark the great change that has come over industry, with benefits to workers, management and public. Our progress in preventing physical injury is not only a great blessing to the employes, but it cuts down waste of all kinds and builds public good will, so essential to every industrial enterprise.

Throughout the year the cement manufacturers who are members in the Portland Cement Association have shown an interest in accident prevention which has made my work as committee chairman both pleasant and easy. What has been done is, of course, merely a good start. The cement mills will reduce accidents still more in 1929—you may be assured of that.

LOST-TIME AND FATAL ACCIDENTS IN MEMBER MILLS OF THE PORTLAND CEMENT ASSOCIATION

	1925	1926	1927	1928
January	249	197	133	94
February	232	183	108	88
March	252	198	140	101
April	236	171	152	118
May	234	174	110	89
June	92	204	59	51
July	231	199	105	85
August	227	198	124	89
September	215	181	123	82
October	259	187	131	81
November	200	164	94	....
December	182	165	88	....
	2609	2221	1379	

Potash

THREE INCORPORATIONS of new companies to produce potash were recorded, two in Texas and one in Alabama, with a total capitalization of $525,000, and one company listing stock as of no par value. The companies which were reported as building or developing their holdings are the Nitrate Corp. of America, Marfa, Tex.; American Potash Co., in west Texas, and other drilling projects in Upton county, west Texas.

The condition of the industry during the last five years can be seen by a study of the following statistics taken from the Department of Commerce reports:

POTASSIUM SALTS SOLD BY PRODUCERS IN THE UNITED STATES

Year	No. of plants	Short tons	Available K_2O (short tons)	Value	Value per ton (gross)
1923	12	35,164	19,281	$ 784,671	$22.15
1924	12	37,492	21,880	842,618	22.45
1925	9	52,823	25,802	1,204,024	22.80
1926	7	51,369	25,060	1,083,064	21.50
1927	9	94,722	49,500	2,448,146	26.20

Whiting

COMPLETE OFFICIAL statistics on the production of whiting from limestone produced in the United States are not available. The production for 1926 was reported as 84,920 tons valued at $651,957, or $7.79 per ton.

A very thorough review of the whiting industry with tabulated production figures, imports, methods of manufacture, sources of raw materials, grades and costs was published in the June 9 issue of ROCK PRODUCTS.

Cement Products Incorporations Recording in Rock Products During 1928

State	No. of incorporations	No. listed with no par value given	Capitalization*
Alabama	1	....	25,000
California	5	1	400,000
Connecticut	1	....	50,000
Delaware	1	....	26,000
Florida	6	5	35,000
Georgia	1	1	....
Illinois	6	1	145,500
Indiana	1	....	5,000
Kansas	2	1	10,000
Kentucky	1	....	60,000
Louisiana	1	....	40,000
Massachusetts	4	1	345,000
Michigan	7	....	330,000
Minnesota	4	....	200,000
Missouri	2	1	10,000
New Jersey	13	5	735,000
New York	17	7	420,000
North Carolina	3	....	275,000
Ohio	4	....	86,000
Pennsylvania	5	3	25,000
South Carolina	1	....	15,000
Tennessee	2	1	10,000
Texas	4	....	76,000
Virginia	1	....	50,000
Washington	3	....	120,000
West Virginia	1	1	....
Wisconsin	1	1	15,000
Total, 1928	98	28	3,508,500
Total, 1927	128	....	10,878,250
Total, Canada	8	2	399,000

*Total of stocks listed with par value..

Cement Products

Cement Products Manufacturers Enjoy Another Good Year

All Types of Concrete Units Share in the Rise in Volume of General Building in 1928

THE year 1928 was another good year for the cement products industry.

Building volume increased slightly and building prices remained practically stationary for the country as a whole. There were only a few major evidences of change in American building trends and habits. Such changes as were noticeable were toward a greater degree of permanence, fireproofness and architectural beauty. These tendencies, all of which are certainly in the right direction, have had good effect on the market for permanent building products of almost every description, including those of the concrete group.

Concrete building products such as block and wall tile seem to be getting a little more than their previous proportion of the competitive business. How much of this increase may be credited to better selling methods and what proportion is accounted for in the more general distribution of lightweight units, with their greater range of adaptability, is problematical. It is probable, however, that both of these factors have had a lot to do with the fact that the increased sales of concrete building materials continues to lead the increase in construction volume.

Block and Tile Flourish

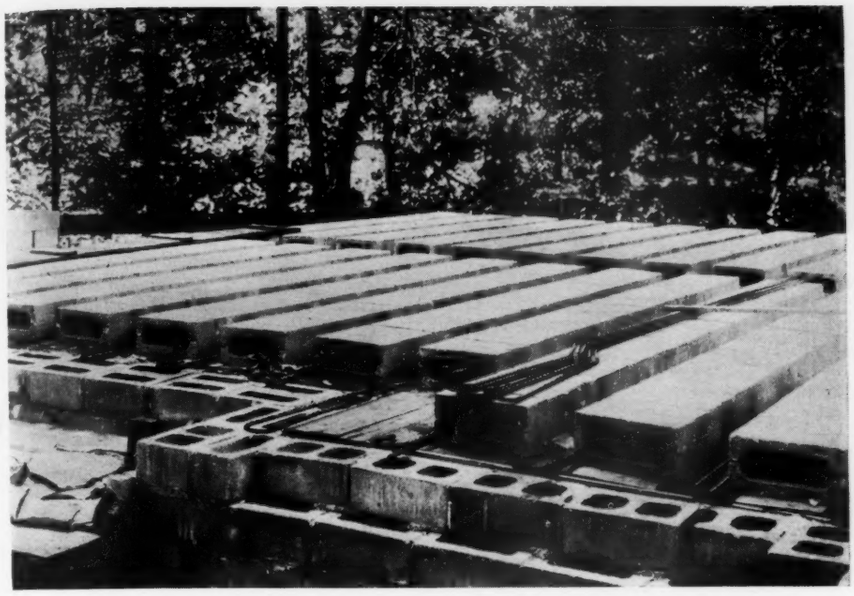
While the number of establishments manufacturing concrete block and building tile remains nearly stationary, there is a noticeable increase in the production volume of the various plants. This increase is more pronounced among the larger plants, although it is evident that many of the modest factories in country districts are enjoying considerable growth. It is interesting to note that in 1922 there were but two plants manufacturing over a million concrete building units per year; in 1927 there were 28 such plants, and in 1928 the number had increased to 44. There have been several consolidations in the larger cities.

Concrete units of acceptable quality are now being manufactured everywhere. Manufacturers who have not chosen to maintain quality standards, or have been unable to do so, have been barred for the most part by city building ordinances or relegated by the weight of adverse public opinion. Progress made in the betterment of quality is most encouraging and has gone a long way toward correcting the unfavorable attitude held so long by the building public. It remains now for the concrete products manufacturers to see that the present standards are not only maintained but improved wherever steps in that direction offer economic advantages to the users or commercial advantages to the industry.

A great deal of the technical progress of the year has had to do with the further development of lightweight aggregates. This comes as the reflection of the widespread public interest which has developed in lightweight units made of cinder and burnt clay materials. Many millions of these units sold for various uses during the past few years apparently have won a great deal of popu-

Pleasing architectural design and handling are to be found in this Flint, Mich., home, constructed of cinder block stuccoed

An inexpensive house of unusual design constructed at Clarks Lake, Mich., of 5x8x12-in. concrete tile stuccoed



Laying a floor of cement tile supported by reinforced concrete beams, at Wellesley, Mass.

larity with the builders and general public.

While concrete block and tile made of these lighter aggregates are to some extent in competition with units made of the ordinary sand, gravel and stone materials, the output of the latter units is at least as great as ever. Most of the lighter variety is going into partition, fireproofing and similar uses in buildings of almost all heights, a field beyond the reach of the heavier blocks.

Straub Patent Upheld

The outstanding development of the year in the cinder block field was the recent decision in the United States Court of Appeals at Philadelphia, upholding the validity of the Straub patent. As there are at present 77 licenses under this patent, and a number of infringers as well as many other prospective licensees, the decision is of interest to the entire industry.

This is the second time that the patent has been upheld by this court. In the case of Straub vs. Campbell, in 1919, first tried by the United States District Court for Western Pennsylvania, the patent was declared invalid, but the Appellate Court reversed the decision and held the patent valid. In the present cases, Crozier Straub vs. Graham, Melmod and Downer, tried originally by the United States District Court for New Jersey in 1927, the lower court dismissed the infringement suits, but again the Appellate Court reversed the decree.

The following is extracted from the decision* filed September 26, 1928, in the United States Circuit Court of Appeals for the Third Circuit. It sets forth the attitude of the court on the issues considered:

"The building block of the patent is a simple one. It is of familiar shape and is intended generally for uses long known. Invention in the product, if any, resides in its constituents, which are cement and water (both old) and 'a mixture of coarse and fine coal cinder and ashes, retaining all of the original mass.' Invention in the process, if any, must be found in the manner of making blocks of this constituency, that is, 'in crushing and grinding an original mass of coal cinder and ashes without separation, mixing the entire mass of coarse and fine material with a suitable proportion of cement and water, and molding and drying the same in block form.'

Patent Rests on Use of Whole Mass of Cinders

"We recognized in the Campbell case that the use of cinders in groutings, foundations, walks, roads and other structures was old, and we learned from the few patents in the record that ashes and cinders, screened or washed or otherwise prepared and selected and proportioned with other ingredients, had appeared in the patent art, but (again from the record) we found that no one before Straub had, when making building blocks, conceived the idea of taking the whole ash product—cinders and ash alike, half burned and wholly burned, lumps and dust—in fact, the entire run of the grate, using the whole waste product in its raw state and rolling or grinding the whole mass. This process appealed to us as new and we also thought the product of the process, namely, the cinder block, was new, not in its form but in its make-up and characteristics. While in form it is that of the ordinary building block, it has marked features, some improvements on old blocks, others wholly new.

Demand for Cinder Blocks

"That the Straub block contains patentably new and useful qualities is clearly evidenced by the unusual demand for it which developed immediately on its appearance in the trade. That the block was new to the building trade, and useful, and has advanced the art substantially, Eible Co. v. Paper Co., 261 U. S. 45, 63, is proved by the fact that in 1919, the year in which the patent was sustained and the patentee began seriously to exploit it, 18,000 blocks were sold by him. In 1926 his 77 licensees sold 24,533,821 blocks, and within the span of these years 77,268,792 had been made by licensees under a royalty of ¾ cent per block and taken by the trade. This in masonry space is the equivalent of nearly 1,000,000,000 bricks."

The decision will do much to clear up the Straub patent situation, which has been the

Concrete flooring has been used effectively in the sun-room of this Los Angeles home

*This decision was published in full in ROCK PRODUCTS, October 13, 1928.

object of much controversy during recent years. The action of the courts seems to assure the validity of the Straub patent, definitely making the cinder aggregate building unit a patented and therefore restricted article. So far as the trade is concerned, this situation may be either advantageous or otherwise, depending upon how it is administered. As men of large business as well as building experience, it is understood that those in control of the patent have every intention of handling it to the best interests of the building public.

Burnt Clay Aggregates

During the last few years interest has been gradually increasing in the use of burnt clay aggregates for concrete products and mass concrete where lightness in weight is a factor. Building units of this material obviously compete with the cinder aggregate blocks and tile. The clay aggregate unit is slightly lighter in weight and considerably lighter in color than the cinder unit, but is less "nailable" and somewhat more difficult to cut. In the lightweight tile market some customers prefer the clay aggregate products and others have a preference for those made of cement and cinders. The combination of these two desirable aggregates places the industry in a favorable competitive position and overcomes the objection sometimes heard to placing all possibilities with a single patented article.

Haydite, the commonly used burnt clay or shale aggregate, which is made by roasting prepared raw material in continuous rotary kilns (similar to but smaller than those used in cement manufacture) is covered by patent, the manufacturers operating under a lease. The material is sufficiently light to permit shipping a considerable distance and has been moved 200 miles or more economically to permit its use in block manufacture.

The increase in the use of Haydite during the last year indicates unmistakable public favor. In 1926 there were only two kilns producing Haydite, the output going largely to the two concrete products plants then using it. In 1927 four kilns were in operation supplying 12 products plants, and in 1928, 12 kilns supply 52 products plants, some 20 dealers, and several concrete contractors. Some of the most successful Haydite operations are now being conducted by successful clay products manufacturers. This feature is giving the clay products industry an interesting picture of the possibilities of clay-aggregate, concrete products such as back-up and partition units, better and possibly more economically made in this way than of molded and baked clay. The Western Brick Co. of Danville, Ill., is an example of a prosperous clay concern now selling many thousands of Haydite block as back-up material for its clay face brick.

A storage garage in Raleigh, N. C., built with cast stone furnished by the Economy Cast Stone Co.

An excellent example of the use of cast stone for exteriors in business structures. Except for a steel frame over the banking room, this bank in Merced, Calif., is of concrete and concrete units throughout

Intensive Selling Principal Need

With an estimated output of the concrete products factories which is but a fraction of estimated capacity to produce, emphasis in the concrete building unit field is being placed largely on selling. The need for greater concentration on the sales problem has been recognized by the Portland Cement Association, the Concrete Products Association and many of the local and state organizations as well as individual manufacturers. Technically, mechanically and financially the industry seems to be "over the hill." True, there is plenty more to be done along these lines, and probably aways will be, but the immediate task is to increase profitable sales to secure economical production.

This subject has been a leading one on many of the products association programs during the year. The Cement Products Bureau of the Portland Cement Association entered on a country-wide program of sales schools, about 60 in number, which reached almost 1200 manufacturers in the leading centers. It is refreshing and complimentary, indeed, to find the concrete products manufacturers getting behind the real fundamentals of successful selling—directing their attention to broadening the market instead of

The railroads are turning to the use of precast concrete units for many purposes, as evidenced by this milepost on the C. C. C. & St. L. in Indiana

Pedestrian subway under the Illinois Central R. R. at the Olympian Fields Country Club, near Chicago, shows one type of concrete structure rapidly coming into use

squabbling for a larger slice of the present volume. By promoting more building, new opportunities are not only opened up for concrete products but for many other materials such as clay, lime, gypsum, lumber and plumbing products, and the competitive struggle is relieved; seeking to increase one material's share at the expense of others stiffens resistance, often runs up sales cost, and may precipitate price recessions.

A typical sales campaign which is broadening the home building market has for its aim the modernizing of old homes. Hundreds of fine old homes, large and small, are to be found in all of the larger cities, and there are at least a proportionate number in the smaller places. Up to the present, many of the owners were not reached by building appeals through the feeling that the old house, while not modern, was too good to dispose of. All such owners are prospective customers for comprehensive home modernizing, and the concrete products manufacturers are actively pushing into this new field.

Greater interest taken by the manufacturers in sales matters during 1927 and 1928 is emphasized sharply by the increase in full-time salesmen at work. Within two months 21 new salesmen were added to the forces employed by plants in the larger cities. In one small county, comprising a large city and its immediate environs, eleven salesmen are employed where the selling was formerly left to take care of itself. While there are now about 300 salesmen working on a full-time basis in this industry, the interests of the plants and surrounding building industries would be more effectively cared for and the public given better service if 1000 salesmen were employed. Competitive clay interests have long recognized the value of sales and service work and have maintained large sales forces for many years.

Concrete products advertising, particularly that relating to the use of block and wall tile in residence construction, has been much improved. The Portland Cement Association contributed to this a large volume of publicity secured in 66 daily newspapers located in the larger cities, through half-page illustrated stories describing the 18 concrete masonry houses designed for the association by the Architects' Small House Service Bureau. These designs are proving very popular and models and plans of the houses have attracted favorable attention wherever shown. Hundreds of inquiries from prospective new users of concrete masonry are being handled by the Architects' Bureau and the association.

Opportunities for concrete block and tile in higher buildings—particularly apartment and mercantile structures—are not yet receiving adequate attention, although an encouraging start in that direction has been made.

Manhole and Catch Basin Block

The production and sale of radial block for manhole and catch basin work has made rapid strides during the present year. Their obvious economy over the use of brick and other materials for these purposes makes it difficult to understand why the introduction of the larger concrete units, molded for rapid and easy laying, was delayed so long. Workmen on city catch-basin work in Chicago were carefully timed on a few jobs and found to require two-thirds to three-quarters of a day to lay the job in common brick, whereas three-quarters of an hour was ample for laying a concrete block catch basin by the same crew.

Twelve additional plants started making radial block for these purposes during the year. Eighteen more have equipment on order or now ready to operate. Some 20 additional expect to enter the business shortly. The business secured by these plants is all new so far as the concrete products field is concerned and it already adds appreciably to the year's volume.

The cast-stone business has had another year of mingled success and hardship. Generally speaking, the larger concerns secured a very comfortable volume of business, although price levels have been depressed by spirited competition between cast-stone producers and with stone and terra cotta. Buyer profiteering goes on mercilessly. As during 1927, several manufacturers retired from the business through economic pressure.

During the year the Northwestern Terra Cotta Co. entered the cast-stone business at Chicago and is now devoting its former terra cotta plant at Chicago Heights to the manufacture of cast stone. This company is financed on a basis which bespeaks the integrity of its undertaking and exhibits the confidence of a competitive industry in the future of the cast-concrete product.

Cast Stone

A largely attended meeting of the eastern cast-stone manufacturers in connection with the convention of the American Concrete Institute at Philadelphia in February, gave much study to the preparation of standard specifications for cast stone, with the expectation that at least a first draft of such a specification will be ready for adoption at a corresponding session to be held at the 1929 meeting of the Institute. This group, which has the general support of cast-stone manufacturers throughout the country, is outlining plans for advertising and other co-operative activities.

In Municipal Work

Concrete sewer pipe made very material advance during 1928. Operating plants now have well equipped facilities for producing or delivering pipe economically at almost all important points in the United States. There has been marked improvement with respect to uniformity of quality and it is safe to state that pipe users never have received so much dependable value for their money as they are getting by the use of concrete pipe under present market conditions. There has

been a steady and very increasing demand.

Manufacturers of concrete lighting standards report a favorable year. Many of the larger cities as well as the smaller towns of the Midwest have been installing new street lighting systems, and a considerable volume of business is being received through the installation of street crossing signs and signals. railroad signals, and replacement of street poles broken in contact with vehicles.

Concrete standards are making rapid headway on the Pacific coast, being the recognized standard in most of these cities for use in residential districts.

Railroad Products

The Pennsylvania Railroad has had several months' satisfactory experience with 25,000 concrete ties installed experimentally last year, and it is expected that further substantial use of concrete ties may be looked for shortly. The Missouri Pacific Railway is now equipping a fence post plant at Webb City, Mo., with the intention of starting a fencing program of large size. Other roads are manufacturing large quantities of concrete posts, crossing and bridge slabs, ties and smaller units running their annual demands for cement for these purposes well toward the million mark.

There has been unusual activity among the larger eastern roads during the year in grade-crossing elimination work. Precast concrete construction for this purpose and for trestles has exceeded the volume of any previous year, although it is impossible to state accurately how large that volume now is. The precast highway for pedestrians recently introduced by the Massey Concrete Products Co. is already in large demand, with prospects that this demand will increase, as this type fills a real need.

The general condition of the concrete products industry is better than at any previous time. The past year has seen tremendous improvement in the operating plants, a moderate but consistent expansion of stocks, great improvement in selling and service features, and many evidences of a more stable financial condition than could be reported heretofore. The great general need for more attention to selling and the development of good salesmanship will probably persist for some time, in view of the excess of capacity to produce which is so apparent throughout the products industry.

Erratum

IN the cement products section of the November 24 issue, on pages 97-98, in the article "More Aggressive Selling and Planned Advertising Needed in the Products Industry," it was stated that the Integrity Trust building was faced with 4-in. cinder-faced brick. The Portland Cement Association has since informed us that this was incorrect. There were about 1,000,000 cinder block used in this structure for fireproofing and filling in backup and partition walls, but the building was faced with clay brick.

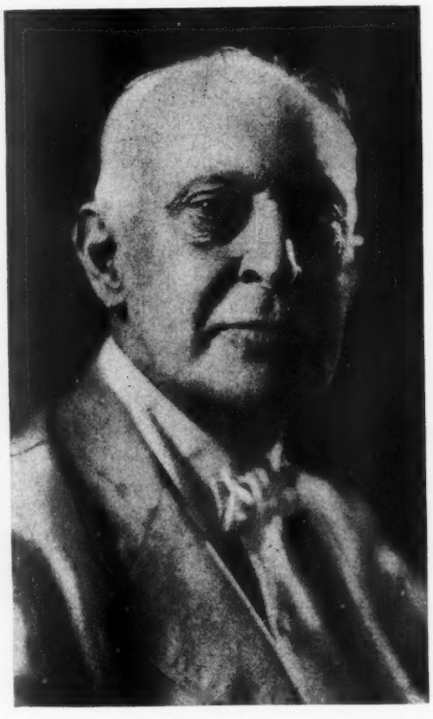
Past and Future of the Portland Cement Industry Viewed by Veteran

George M. Newcomer Believes Early High Strength Cement Has Come to Stay and Demand for It Will Grow

IT WAS THE EDITOR'S pleasure and privilege recently to interview George M. Newcomer at his home in New York City. Mr. Newcomer, as every American cement manufacturer knows, was *the* pioneer who introduced and promoted the wet-process of manufacture in the United States. Recently he retired as first vice-president of F. L. Smidth and Co., in charge of the American corporation, to enjoy a well-earned rest.

Mr. Newcomer had represented the Aalborg Cement Co., of Denmark, an F. L. Smidth enterprise, in New York City, for two years when F. L. Smidth and Co., who are both operators of cement plants and builders of cement mill machinery, decided to establish an American corporation. This was done in 1895 and the American corporation was conducted as an entirely independent concern, except for dependence upon the Copenhagen associates for valuable knowledge, experience and research.

It was not until 1901 that the first wet-process plant was built by the Denmark company at Berghausen in Germany—the Karlsruher Lime and Cement Works. It was 10 years—in 1911—before the first American portland cement manufacturer could be induced to install the wet process, although in those 10 years 35 wet-process plants were built in nearly every other quarter of the globe. During that time F. L. Smidth and Co. sold merely cement-mill machinery and engineering service.



George M. Newcomer

Mr. Newcomer's advocacy of the wet process, we believe, is based on the conviction that portland cement manufacture should be an exact chemical process, and that the wet process lends itself to exact chemical control more readily than the dry process. He can foresee great advances in the chemical control of portland cement manufacture, and possible revolutionary changes in the present manufacturing methods, when we know more about the chemical reactions involved. He thinks Europe is progressing faster toward such a goal than the United States, because in Europe research by various agencies, including cement manufacturing companies, is ever on the alert to discover new processes—particularly in the use of byproducts of other industries.

High early strength cement, Mr. Newcomer is sure, has come to stay; and he believes that in a few years there will be slight demand for any other kind of portland cement. The time-saving, labor-saving elements in the use of high early strength cement, in his opinion, transcends all other considerations. Also, he thinks that high early strength cement, if properly made, is just good portland cement—the kind of cement that all plants can and will make when they have subjected their mills to adequate chemical control.

In the grinding of portland cement, Mr. Newcomer thinks there is small chance for any great saving over and above present practice and equipment. Grinding has always been recognized as an expensive operation and has been the subject of much discussion and research. Greater economy in grinding, he thinks, can come only from better chemical control of the product—more accurate proportioning and control of mixing and burning—rather than in refinements of grinding apparatus.

Mr. Newcomer takes considerable pride in the fact that grinding portland cement has always been one of his special studies. In 1905 he contributed a paper to the quarterly meeting in April of the Association of American Portland Cement Manufacturers —the forerunner of the present Portland Cement Association. Other contributors to the same session were James E. Howard, Henry S. Spackman, George H. Fraser and Spencer B. Newberry.

The large compartment mill, with an adjustable screen, which is equivalent to changing the length of the ball-mill compartment, he thinks represents the highest present limit in fine grinding machinery.

Sand-Lime Brick in 1928

Several New Plants Mark This Year's Development

THE sand-lime brick industry has seen a good year for the most part in 1928, although some of the sections of the country, notably the southeastern portion, did not show a very healthful condition. Production over the whole country was probably over 320,000,000 brick during the year. Prices remained much on the same level as in 1927. ROCK PRODUCTS has for several years sent out monthly and annual questionnaires to producers in this country and Canada, and it is from these that the estimates are drawn. On an average 25 plants return these each month, or something better than one-half the plans now operating.

The following are average prices quoted for sand-lime brick in November:

Average Prices for November

Shipping Point	Plant Price	Delivered
Albany, Ga.	$10.00	.....
Boston, Mass.	12.00	$16.00
Buffalo, N. Y.	12.25	16.25
Dayton, Ohio	12.50	15.50
Detroit, Mich.	.....	16.00
Detroit, Mich.	.....	15.50@16.00
Detroit, Mich.	13.00	15.50
Detroit, Mich.	13.00@14.00	15.50@16.00
Detroit, Mich.	.....	.....
Grand Rapids, Mich.	12.50	.....
Jackson, Mich.	12.25	.....
Madison, Wis.	12.00	13.00
Milwaukee, Wis.	10.50	13.00
Minneapolis, Minn.	10.00	12.75
Mishawaka, Ind.	11.00	.....
Pontiac, Mich.	12.00	14.00
Rochester, N. Y.	.....	19.75
Saginaw, Mich.	12.00	.....
Sebewaing, Mich.	.....	.....
Syracuse, N. Y.	18.00	20.00
Toronto, Canada	12.50	15.00
Winchester, Mass.	.....	16.00

New Plants

Three outstanding sand-lime brick plants have been placed in operation during the past year. Two of these, the Atlas White Brick Co. plant and that of the Paramount Brick Co., were mentioned in the 1927 review of the industry as being close to completion. Early in the year the former closed its plant at Atlantic City, N. J., and moved its operation to the new plant near Berlin, N. J. It is a 3-unit operation with a convenient straight-line layout and most of the equipment is new Jackson and Church machinery, although a small portion was transferred from the old plant. The second plant, that of the Paramount Brick Co., was also occupied early in the year. This plant is exceptionally well located directly on the waterfront at Brooklyn, so that material is received and the products are shipped out by either rail, water or truck. The equipment was furnished by the Komnick company.

In the middle west the important plant is that of the Northern Indiana Brick Co., which had occupied its old plant at Michigan City, Ind., for the past 18 years. When the company decided that a shift was necessary, it was decided to move the operation bodily to Mishawaka, Ind. The new plant was constructed and ready for occupancy when the company transferred its operation about the middle of the year.

Another plant which is nearing completion is that of the Hardstone Brick and Tile Co. of St. Louis, Mo. This will be a three-press operation and two of the presses are already installed and are now turning out brick. The building is constructed of steel, concrete and brick, and it was left in skeleton form while the presses were being installed, so that the company could manufacture its own bricks for the walls. The plant will be completed early in 1929.

Plant Changes

The past year has not been a very strong year for plant improvements in the industry, but some were made in the northern plants. During the spring the plant of the Wisconsin Brick Co. at Madison was closed down while extensive improvements were being made. At the same time the Columbus Builders Supply Co. completed some improvements in its plant at Columbus, Ohio. The Michigan Pressed Brick Co., Detroit, Mich., installed one more hardening kettle at its plant.

The Paramount Brick Co. of Brooklyn, which went into operation in its new plant this year, as mentioned above, has already commenced a program of extensions. At present the Holly Pneumatic Systems, Inc., of New York, is installing a pneumatic system for unloading granulated lime from freight cars to a large storage tank and subsequently transferring the pulverized material to the plant.

Apparently southern plants have not fared well this year. Two plants have been closed down during 1928, and the plant of the Albany brick Co., at Albany, Ga., is now for sale. The other inactive plant is that of the Palm Beach Brick and Stone Co., at West Palm Beach, Fla. The Plant City Brick Co., Plant City, Fla., made a number of improvements and replacements during the year, necessitating the closing down of the plant for a considerable period.

As a general rule there is little indication of extensive improvements during the coming year, just as the improvements during 1928 have been minor for the most part. The attitude of the producers seem to be fairly well summed up in the words of one southern operator, who says: "No additions are contemplated, as our capacity now is greater than our demand."

Several producers reported that they are producing sand-lime block at the present time. This is a comparatively new venture, as far as producing in real commercial quanties is concerned, since hardly any plants were manufacturing this product prior to 1928. One producer had manufactured this product but was no longer doing so. As far as hollow brick were concerned, the reporting producers evinced not the least interest, not one manufacturing these units or contemplating their manufacture. Some little experimental work was reported on lightweight brick, glazed sand-lime brick and other units.

The questionnaires which were returned to ROCK PRODUCTS on the whole contained some quite interesting opinions and suggestions helpful to the industry in general. While it is not possible to quote all the replies, some of the representatives ones follow:

Competition from Clay Brick and Other Materials

Competition much greater by sand-lime brick.—*Michigan.*

* * * *

From hollow clay back-ups due to state ruling allowing hollow units where only solid were permitted.—*Ohio.*

* * * *

No greater in 1928.—*Michigan.*

* * * *

Control of the Establishment of New Plants

Suggest that all inquiries be referred to the Sand-Lime Brick Association.—*Ohio.*

* * * *

By a survey of local conditions only.—*Michigan.*

* * * *

Suggest the sincere practice of the "Golden Rule."—*Michigan.*

* * * *

When a man has more money than sense it is pretty hard to stop him from putting in a plant.—*Florida.*

PRODUCTIONS, SHIPMENTS, STOCKS AND UNFILLED ORDERS OF SAND-LIME BRICK, IN MONTHS, 1928

Month	No. of plants reporting	Production	Shipments—Rail	Shipments—Truck	Stocks at end of month	Unfilled orders
January	25	12,789,000	4,944,500	7,024,100	15,867,000	14,830,000
February	26	10,920,600	3,737,900	6,203,500	16,920,200	12,625,000
March	26	17,063,100	4,272,900	9,390,800	16,777,200	16,942,000
April	24	10,011,900	4,828,700	9,182,300	15,120,600	14,123,000
May	27	22,244,400	7,751,700	18,228,900	12,159,000	14,445,000
June	23	19,133,300	5,120,300	14,437,000	11,656,000	11,718,000
July	24	18,071,800	6,054,700	11,771,600	12,591,300	11,762,000
August	27	21,680,100	8,284,400	13,214,500	14,445,800	14,503,000
September	26	17,266,500	6,767,300	11,281,400	15,304,100	14,455,000
October	25	21,589,800	5,562,300	15,801,600	14,446,100	13,435,000
November	21	18,164,100	4,588,300	12,942,400	11,578,800	10,447,000
December*	25	16,000,000	5,000,000	11,000,000	12,000,000	12,000,000
Total		204,934,600	66,913,000	140,478,100	168,866,100	161,285,000

*Estimated for 25 plants.

Progress in Foreign Research and Technology of Rock Products in 1928

A Summary of Abstracts and Scientific Papers Published During the Year

Composition of Cement

Alit and Jaeneckeit have been the targets of controversies between Kuehl and Jaenecke.* The binary and tenary diagram of the lime-silica alumina system was dealt with by a Japanese (7, 79). According to Pruessing, ore cement has been shown superior* to high strength portland cement in respect to aggressive water, solutions and fumes. Itsuo Yamazawa (10, 105) prepared and analyzed fused portland cement and an alumina cement in an arc type electric furnace and made comparative analyses and tests with finely powdered portland cement. Lafuma (17, 85) stated that chemical reagents may destroy mortar either by solution of a constituent or by combination with the ingredients, and that every reaction which takes place between solid salts without previous solution has a deleterious effect upon the strength. Luftschitz (21, 107) urged to determine the effects of mixing different brands of cement with each other and mixing various types of cement with each other. Portland cement has been given a thermal analyses (6, 101) (7, 79) with a thermo balance. A survey of the special high strength cements has been made by Rengrade.* Nacken (5, 80) concluded from an x-ray study of the constitution of cements that dicalcium silicate in a metastable form is the carrier of the properties of portland cement. Schwarz (24, 92) has concluded that (SiO_2) can form at least two hydrates, that meta-acid ($SiO_2 \cdot H_2O$) and the di-acid ($2SiO_2 \cdot H_2O$) which are both hexametric.

Clinker Composition

To the use of the standard test material for determining lime in the raw mix—a mixture of raw materials of exactly determined standard composition with which methods of analysis are checked occasionally to find possible errors—F. Kubik (21, 106) adds in parallel the titrametric and the calcimetric methods, and he finds that the raw mixture should be held at 76.56% in the titrametric method and 77.28% in the calcimetric method in order to approach the value of 76.11% $CaCO_3$ found in the chemical analyses. Richarz has made a survey of the literature on the constitution of portland cement clinker (22, 101), while Diepschlag and Matting have made an extensive review of literature on the determination of free lime in clinker and concrete, including 129 references.* Rissel* reviewed the work of the Ernst brothers, Mueller and others on the investigation concerning the processes in rotary cement kilns. A Japanese research (7, 79) deals with the melting curves of limestone clay mixtures used for the manufacture of portland cement. The process of burning in the automatic shaft kiln has been dealt with by Hammerschield and Kuehl.* Guttman (11, 88) more or less positively identified the various mineral constituents of portland cement clinker, which are alit, belit, dicalcium silicate, free lime, celit and calcium aluminate. Kuehl* held that the best cements were obtained with clay of a somewhat abnormal composition, making portland cements either especially fat or especially lean in silicic acid, effected by adding to the raw mix quartz, flint or sand in the first case; ground bauxite, iron ore or certain slags in the latter case. A new product, from portland clinker, blast furnace slag and schist slag, is compared with portland cement and found more resistive* to acids and salts due to low lime and high silicic acid content.

Hydration and Hardening

Biehl (17, 84) explained the phenomena of the setting and hardening of hydraulic cements by this that the setting starts with a crystallization process with which appears a gel formation which has a great influence in the hardening process. Garre (15, 85) showed that lead oxide may act as a complete retarder or destroyer in the hardening of cement. Kumagae and Yoshioka (12, 88) made a microscopic study of the process of hydration of commercial aluminous cement and "super-cements" of the portland type. As shown by Gessner, high early strength portland cement is particularly adapted for use under unfavorable weather conditions (9, 82). Kordes shows (9, 82) that material in crystallized state is capable of entering into chemical reaction. A study has been made of the temperature rise during the setting of portland cement containing different percentages of calcium chloride (8, 112). Kuehl made a study* of the variable hardening of portland cement according to the K1 storage, and the latter, implying variable hardening over a 56-day storage period, has received considerable discussion.*

Biehl developed the steam hardening test for obtaining 28-day strengths in two days, exposing the test samples for a certain period under a certain steam pressure, 235 lb. for eight hours found to be most suitable (22, 100). The hardening energy of portland cement was increased by adding ground "catalysers" to the burn,* as that of about 2% of calcium bromide. Dr. Guttman (11, 88) observed five products of hydration in portland cement clinker which are calcium hydrate, hydrate of tricalcium aluminate, calcium hydro-silicate, calcium sulfo-aluminate and cement bacillus, etc.; silica gel. Gruen* made extensive laboratory studies of the setting and hardening process of concrete in freezing shafts, while Graf* rendered an extensive research review and laboratory study concerning strengths, shrinkage, chemical resistance, etc., of cement mortar and concrete. CO_2 gas (6, 101) was found to cause portland cement containing 1.4% SO_3 to set slow.

Nitzsche found (22, 101) that the start in setting is accelerated with an increase in temperatures and that covering the vessel containing the cement sample retards the start of setting due to a decrease in evaporation. Calcium chloride (6, 101) is found to accelerate setting and hardening and increase tensile strength for certain conditions. Cocagne and Matras made observations on the shrinkage of cements under constant temperature and humidity* conditions, while Vierheller experimented with alumina cement in respect* to hard-

Editor's Note

***THE NUMBERS** in parentheses accompanying the condensed reports given herewith refer to the issue number and page on which more information on the subject can be found. For example,* 1, 69, *means January 7 issue, p. 69, and for convenience the pubication dates corresponding to the issue numbers for 1928 are given below, incuding the number of the first page of the "Foreign Abstracts and Patent Review" of each issue:*

No. 1	*Jan. 7;*	*69*
No. 2	*Jan. 21;*	*96*
No. 3	*Feb. 4;*	*76*
No. 4	*Feb. 18;*	*94*
No. 5	*Mar. 3;*	*80*
No. 6	*Mar. 17;*	*101*
No. 7	*Mar. 31;*	*78*
No. 8	*Apr. 14;*	*112*
No. 9	*Apr. 28;*	*82*
No. 10	*May 12;*	*104*
No. 11	*May 26;*	*88*
No. 12	*June 9;*	*88*
No. 13	*June 23;*	*96*
No. 14	*July 7;*	*94*
No. 15	*July 21;*	*84*
No. 16	*Aug. 4;*	*102*
No. 17	*Aug. 18;*	*84*
No. 18	*Sept. 1;*	*92*
No. 19	*Sept. 15;*	*98*
No. 20	*Sept. 29;*	*84*
No. 21	*Oct. 13;*	*106*
No. 22	*Oct. 27;*	*100*
No. 23	*Nov. 10;*	*92*
No. 24	*Nov. 24;*	*92*
No. 25	*Dec. 8;*	*62*
No. 26	*Dec. 22;*	—

***The asterisk** used in the condensed reports refers to further information that has not yet been published in Rock Products.*

ening in ice water. Shimizu (20, 84) describes an electrical method for measuring the setting time of portland cement, which though affected some by temperature variations caused by setting, is considered better adapted and more accurate than the mechanical and thermal methods.

Kuehl summarizes recent ideas in cement chemistry in this that the hardening of cement is a colloid-chemical shrinkage process of a mass of swelled gel, consisting of the formation of gel from cement and water at the surface of the cement grains and a shrinkage of this mass of gel by interior suction which latter comes into effect in that the still undecomposed cores of the cement grains withdraw water for their own hydration from the masses of gel formed on the surface of the grains and cementing them;* these gels being calcium hydro-silicate in silicic cements and alumina hydro-silicate in alumina cements. He presented the following approximate equations showing in the first a disintegration and in the second a synthesis of the lime-abounding combinations of the reacting constituent under simultaneous liberation of calcium hydroxide in the first and alumina hydroxide in the second case:

$3CaO \cdot SiO_2 + xH_2O$ is $2CaO \cdot SiO_2 \cdot yH_2O + Ca(OH)_2$ $3(CaO \cdot Al_2O_3) + xH_2O$ is $3CaO \cdot Al_2O_3 \cdot yH_2O + 2Al_2(OH)_6$.

Physical and Chemical Analysis

Dugordin (10, 104) made a study of portland cement and concrete testing in different laboratories and different countries, showing differences in results as great as 47%. A series of tests on ready mixed trass-portland cement gave striking evidence of (25, 62) of the importance of maintaining the test series, due to the variability in strengths of cement over certain periods, for an extended period in order to secure reliable results. A quick method for determining the consistency of volume (6, 101) of portland cement is described. Schuen describes the use of triaxial diagrams for various cements, slags and clays (12, 88). Souell (19, 98) has found a method to determine traces of slag in cements by means of lead acetate treatment, resulting in change of color. Haegermann made a study of the unit weights of portland cement (11, 88) giving factors for obtaining hectoliter weight from liter weight.

Rathke, in determining free lime, improved upon the glycerin ammonium acetate method of Emley by using a different titration material, namely a 1/10 solution of pure crystallized tartaric acid with which the calcium glycerate can be titrated cold, using phenolphthalein as indicator. Mecke* studied the chemical action of lime upon the Si substance and trass and suggested the method of determination of the quantity of baryte fixed by the Si substance in place of the incomplete method of determining the soda soluble acid, and described the baryte process. Steopoe* investigated the chemical reaction between trass and lime, using Florentin's method. Gelber* described a rapid method for determining iron in hydraulic binders. A study of (3, 77) was made of the effect of different procedures on the results of the analysis of portland cement. Schott* investigated the causes of the cracking of glass slides. Powdered magnesium oxychloride cements were studied (6, 101) with the x-ray.

Efforts are being made to substitute efficient mechanical methods for screening by hand and to improve mechanical screening methods; one solution being that of placing small round headed brass nails in a machine-operated screen with the material to be screened (25, 63), so as to prevent clogging of the screens by aid of the nails which clean the meshes continually. Gonell* described the various processes for determining the granular composition of cement and improved upon the Pearson and Sligh air-screening method by developing a special air separator operated with forced air, and giving accurate results with a maximum deviation of 3%. Dr. Foerderreuther's screening machine* is described in a study of the abrasion of cement mixes, which gives reliable and quick results. Werner and Hedstroem (7, 84) presented a new type of apparatus for determining sedimentation of granules of cement, recording the results on special charts. Gruen and Kunze* have developed a method of graphic estimation of raw mix by the use of coordinates on a rectangular isosceles triangle, permitting rapid analyses of any number of constituents of the mix or its clinkering component.

Cement Patents—Admixtures

Kallamer and Pospisil (14, 64) obtained a rapid setting cement of considerable strength by mixing fine litharge with glycerine which has the formula $C_3H_6O_3PbO$, according to Morawsky. A Dutch patent (15, 85) covers the use of natural crystalline silicic acid for producing portland cement, sand being mixed with limestone to form calcium silicate, and several oxides being added. Kuehl* described a process for manufacturing sulphuric acid from gypsum with portland cement as a by-product, and another process for producing alumina cement as a by-product in the manufacture of phosphoric acid by the addition of coal and bauxite to the raw phosphate, and mentioned the possibilities of utilizing lime slurry residues, etc., as in further treatment of the lime-nitrogen and the calcium carbide. In reference to a U. S. Patent, Platzmann found (1, 69) the admixture of ¼ to 2% lime for the acceleration of the reaction $2Al + 3Ca(OH)_2$ is $Ca_3(AlO_3)_2 + 3H_2$ to be unnecessary. A large number of patents and processes involving cement (1, 69) is credited to Japanese cement chemists. Fused cement* is made by heating bauxite and lime separately to a high temperature and then delivering them simultaneously to the fusing chamber. According to a German patent, an intricate mixture of clay with quick, dry or slaked lime is calcined, using oil as fuel, and the product ground to cement. A number of Japanese patents (3, 77) include a method of making white cement, magnesia cement, fired cement ware, etc. A German firm supplies a portland cement to which the trass is already added in correct proportions (25, 62).

Cement Kilns

A considerable number of suggestions for improvement of cement kilns have been made and patented. A French ash fusing gas producer for producing gas and converting ashes into slags and cast iron, the slag to be used for manufacturing cement, is equipped with an air heating apparatus consisting of two groups of tubes in series, one set being made of fused quartz and the other of metal, through which the air is passed at a velocity of 100 ft. per second, its flow being broken by the interposition of materials which are heated by radiation and release their heat readily to the air passing by them, so that the capacity and efficiency of the tubular heaters is doubled. The principle is that the air for combustion passes at high speed (23, 92) through a cellular structure of material which is heated from the furnace and releases its heat easily to the combustion supply air. Stehmann (19, 98) has made improvements on his rotary kiln, thus effecting a fuel reduction of 23 to 26% for the wet process. Kyriaeou suggests (20, 84) the use of a swell at the entrance to the sintering zone in order to retard the flow of the mix in the calcining zone of the rotary kiln. The modern German automatic shaft kiln of the Mannstaedt design for burning dolomite (5, 80) is adaptable to the cement industry. One patent (3, 77) covers the providing of an attachment of channels to convey the material, while air for combustion is passed through axial conduits.

In British patent* the cement slurry is atomized into the kiln gases of the wet process rotary kiln. Another British patent covers the installation of baffles in the decarbonating zone of rotary kilns (15, 85) to lengthen the path of the gases; and another British patent (12, 88) provides for the supply of air to the kiln through ring-shaped conduits arranged at various heights between the clinkering zone and discharge. A French patent (2, 96) covers the conveying of the raw material for clinkering in small cars through a tunnel. Naske (10, 104) described a rotary cement kiln operating on the uniflow process, fuel and material being supplied from the same end, and he attributes an

efficiency of about 74%, provided clinker heat and flue gas heat are utilized to 85% and power is generated with flue gas heat. Kuehl (16, 102) concludes that in the automatic shaft kiln the burning of the fuel pressed into the raw cement material briquette takes place by the direct influence of air upon the burning fuel in a temperature zone which lies far above the dissociation temperature of the calcium carbonate. The operation of the rotary kiln (9, 82) and its design is described by Schuster. A special design of cooling shaft which assures thorough aeration of the clinker granules* on a grated dust cone through which air is forced from below, is covered by a German patent.

The kiln commission of the Association of German Cement Manufacturers has continued its series of investigations of different types of cement kilns* in respect to operation, output and efficiency. An interesting development in connection with cement plants is the Ventoplex air current separator.* The S. P. I. G. electric dust recovery plant,* and the reduction of man power (7, 78) are other items of interest. The utilization of waste heat is an important problem* touched upon by Eck in describing the Marguerre installation of his plant. A British patent (14, 64) covers the atomizing of a slight percentage of water into the grinder to lower the temperature of the cement or raw material sufficiently to prevent clogging. Biehl (17, 84) described the Andreas shaft kiln as being supplied with air for combustion at the center instead of the rim of the kiln which assures better clinker and better air distribution.

Cement Standards and Regulations

An effort by government to specify the chemical composition of domestic and imported cements is shown in the recent Dutch cement standards (25, 62) which comprise very elaborate specifications, according to which portland cement must have at least 1.7 parts by weight of CaO to 1 part of $SiO_2+Al_2O_3+Fe_2O_3$; iron portland cement 70 parts by weight of portland cement clinker and the balance granulated basic blast furnace slag of the composition

$$\frac{CaO+MgO}{SiO_2+Al_2O_3}>1$$

and blast furnace slag cement 15 to 60 parts by weight of portland cement clinker and granulated basic blast furnace slag of the composition

$$\frac{CaO+MgO+\frac{1}{2}Al_2O_3}{SiO_2+\frac{2}{3}Al_2O_3}>1$$

with a maximum content of 5% MgO. The maximum contents of magnesia, of sulphuric acid anhydride, and of particles insoluble in silicic acid are also specified. In Germany (12, 88) the special admixtures to slag cement of the above formula are limited to 3% of the total weight. Besides the specifications for Japanese (9, 82) cements, there are those for Poland (9, 82); and Italy (9, 83) (24, 92) in which a distinct classification of hydraulic lime, high hydraulic lime, rapid setting cement, and slow setting cement of qualities I and II is made, and they prescribe* severe regulations for the manufacturers.

Lime

Bolomey rendered a general discussion of the historical, economical and chemical development* in the lime and cement industry. Huettig showed by describing the various reactions (23, 92) that the burning of lime is not such a simple process as is universally assumed. The process of lime burning (14, 95) is summarized by the equation $CaCO_3$ is $CaO+CO_2$, which reaction is dependent on the temperature and pressure in respect to different limestones; the calcium oxide produced in burning may be regarded as having the properties of a solid gel. Research tends to show (17, 85) that inhaled lime dust is of special value in curing of pulmonary tuberculosis. Budnikoff* investigated the manufacture of clay limestone from the viewpoint of colloidal chemistry, finding that by using clays of certain chemical composition under certain conditions, a rather firm clay-lime may be produced without burn; whereas Graham* rendered an introduction on colloid chemistry. Merceron-Vicat retrospected on the scientific development of the theories* of hydraulic limes and cements.

In one instance calcareous stone is treated with sodium silicate (6, 101). In slaking lime with steam, the rate of hydration (6, 101) accelerates with an increase in vapor pressure, giving quick results.

Lime Kilns

Halbig has made* a detailed account of the heat consumption in a gas-fired and a brown coal fired lime kiln, analyzing the distribution of the heat supplied in the kiln. A coal gas fired kiln of unusual design has been installed in Upper Silesia (16, 102) which is provided with automatic folding traps and operating equipment, producing 75 metric tons of lime daily by utilizing waste heat. A German patent* covers a new design of discharge funnel with guiding plates. Klehe* described the rotary kiln for the lime industry, while a number of recent foreign kiln developments have been touched* by Wolcen. A comparison between American and German lime plants was made by Lange (10, 104).

Gypsum Research

Foreign publications show considerable activity in gypsum research and production. Budnikoff (15, 85) has developed standard specifications for gypsum plaster, suggested standards for stucco gypsum* for Russia, made a study* of the rapidity of hydration of the dehydrated gypsum, reported (8, 112) on extensive research on gypsum in reference to accelerators and retarders, acids, various salts and hydration, and observed the effect of accelerators and retarders (23, 92) on the rapidity of hydration of stucco gypsum as an increase or decrease in the solubility of the gypsum and variation in the rapidity of the coagulation of the gypsum gel, and formation of double combinations and substitute reactions between the sulphuric acid calcium and the introduced combinations. The composition and characteristics of plaster were described by Pellat* and Chassevent* describes its manufacture, while a number of articles dealt with stucco gypsum.* There are only two successful processes for the chemical utilization of gypsum (4, 94). In the Testu de Beauregard process the gypsum is burned* by the use of superheated steam, resulting in a pure white product. Several leading foreign kilns for burning gypsum* have been described. A German patent* covers the process of making insulating material of gypsum to be taken from the form a few minutes later, while a British process covers the manufacture of a porous gypsum compound* by treatment with a dilute mineral acid. Matignon and Frejacques reported the production of a cement of the composition SiO_2, 23.59%; Al_2O_3, 4.28%; Fe_2O_3, 1.85%; CaO, 66.77%, TiO_2, 0.26%; MgO, 1.2% by burning (17, 84) the filter residue obtained in producing ammonia sulphate from gypsum.

Magnesia and Magnesia Cements

Magnesite has been analyzed (17, 85) as belonging into nine groups, of which the fourth group is the most favorable for marketing; the most favorable Fe_2O_3 content was found to be between 5 and 7%. A British patent (2, 96) covers the manufacture of insulation from magnesium containing minerals, by fusing them and breaking them up in a stream of compressed air. A French patent (3, 77) covers the production of magnesia from dolomite.

Alumina Cement

Vierheller (20, 84) reported that alumina cements can be used for concrete even at the lowest temperatures as compared to high test portland cement; he tested (3, 77) the effects of cold water on alumina cement, concluding that the set of alumina cement is less influenced by low temperatures than that of high strength portland cement. Charrin* described bauxite and its substitutes for alumina cements. Vierheller (18, 92) showed that alumina cement can be drowned and also mortar, but that CO_2 is harmless. Feret described recent researches on the alumina cements and also the elaborate tests* on alumina cements. A bauxite of 70—90 parts of alumina and 30 to 10 parts of lime

is fused in an electric furnace and the slag fused with crude phosphates. LeChatelier (15, 84) determined that the hardening of alumina cement depends upon the formation of monocalcium aluminate.

Aggregates and Admixtures

Schlyter has compiled the results of tests on granite, diorite, limestone, quartz, sandstone, gneiss, diabase and other rock products (22, 101) for road construction. A mixing proportion of 80 weight parts of portland cement and 25 weight parts of Nettetaler trass (21, 106) is recommended by a German firm to obtain high strength concrete stone. It is recommended (23, 93) to use those aggregates or fillers for preparing portland cement mortar, which set and harden the lime in cement, such as the finely ground blast furnace slag, silicate material and trass. A British patent (19, 98) covers an improved separator for removing earthy materials from gravel or sand by a combined washing and separating process. Stradling (12, 88) reports that in the use of cinders, coal and coke breeze for concrete aggregates there are classes of coal which are dangerous if added in unburned or slightly oxidized condition. A new acid-proof concrete "Prodorite" is obtained (24, 92) by adding a special organic binder under use of coarse and fine stone aggregates and the mortar is prepared hot with special machinery.

A German patent covers the manufacture of hard wood from vegetable fibres, trass, etc., with cement as binder and reenforced with impregnated textile fibres, calcium chloride being added to increase the binding between sawdust and cement, and ferric chloride to increase the strength and assure an oakwood color; and in another German patented process sawdust and wood shavings are treated with potassium nitrate and lime milk and a part of it with potassium carbonate, dried and mixed with portland cement and water to be pressed into boards (21, 106), but mineral fillers may be used also. A British patent (22, 101) covers the manufacture of artificial stone by forming a gel from an inorganic or organic material and adding a hydraulic binding media.

A German process (15, 84) has been developed in which ceramic or other objects may be covered with a siliceous precipitate of great chemical resistance by exposing them to some neutral gas mixed with a carbon and hydrogen compound of silicon. Two patents (7, 79) deal with the manufacture of artificial stone with cement as filler. Wire-reinforced elastic concrete wood is covered (13, 96) in a Czechoslovakian patent, and an artificial stone (4, 94) in a British patent.

Concrete

The subject of strengths, shrinkage and chemical resistance of various concretes has received considerable attention (see also under heading Hydration and Hardening). Freyssinet made an extensive study* of the influence of the quantity of water in mortar upon the quality of concrete, and Dumolard studied the action of pure water upon different hydraulic binders. The German Concrete Association has published some data on the permeability to water of variously prepared (24, 92) concretes. Biehl* determined the destruction of concrete by aggressive carbonic acid by the phenol phthalein reaction method. Magnard's book, "The Pathology of Reinforced Concrete" is* reviewed, and Rick* reviews the action of acids and salts on cement in concretes. Budnikoff and Leschoeff* stated that the rapidity of destruction of concrete depends upon the quantity of Al_2O_3, the concentration of the sulphate, the porosity and the hydrostatic pressure difference and, in their study of admixtures of various modifications of calcium sulphate upon the mechanical condition of portland cement. The danger of sulphuric acid in concrete (22, 101) is greater in calcareous and alumina cements so that blast furnace cement or iron cement, low in alumina content, and especially the Ciment fondu, are preferable; portland cement is rendered resistive by adding trass.

Richarz* stresses the desirability for cement improvement and concrete improvement and suggests trass as the improving medium for resistance to sea water and elasticity, in preference to high strength. The detrimental result of a concrete of alumina cement (15, 84) worked and placed to dry is shown by F. Beucht. V. Colberg (12, 88) made a study of the effects of oils on concrete. A Japanese patent covers (4, 94) an acid-proof cement; a British patent (6, 10) covers water-proofing. Bolomey devised (11, 99) formulas for concrete in respect to the effect of surface condition of the aggregates. Friesche (15, 84) made experiments to obtain concrete mixtures of maximum density by aggregate grading methods upon the basis of a study of spherical bodies. A study was made by Russian investigators* of the suitable granulation of sand for concrete and cement mortars, and Jufereff* also made a study of the influence of clay in sand upon the strength of portland cement mortar, and the percentage of clay should not exceed two.

The physico-chemical phenomena in building materials has been studied by McBain (14, 94) and summarized in a table showing the sorption of water vapor at definite relative humidities, certain building stones being exempt from the disintegrating action due to the fluctuating humidity. Dr. A. Guttmann (18, 92) offered a number of suggestions on poured concrete and specifications for strength. A series of tests on ready mixed trass-portland cement batters showed the importance of coating concrete structures for (25, 62) preservation.

A re-enforced concrete transmission tower (24, 92) is manufactured, which is said to be of better quality due to the application of the Kisse process in which the pouring forms are pounded continually with a large number of vibrators while concrete is being poured, so that a greater percentage of cement gathers towards the rim, thus assuring water-proof construction. The chemical and physical characteristics of cement mortar and concrete of different granulation were recently determined in tests by Graf.* In subjecting them to sodium sulphate (13, 96) cements with admixtures of slag deteriorated completely inside a year, finely pulverized portland cement did not deteriorate until in the third year and ore or ore cement showed no deterioration after seven years.

Porous Concrete

It would be impossible to deal in this annual review in detail with any particular subject, for that is done in the original articles and monthly abstracts. Meyer* reported on various processes for producing porous or gas concrete, using, however, alloys of high calcium content for his process. A German patent covers the manufacture of porous insulation from fine dust (14, 95), such as received from flue gases, etc., by electric precipitators. In another process* portland cement, slag sand and a special preparation are employed. A Danish porous concrete* is made of potassium soap foam and liquid cement milk cast into forms. A porous concrete for heat and sound insulation (5, 81) is covered by a French patent.

Magnesite

THE VALUE of imported magnesite up to 1927 was larger than either of the productions from the state of California or Washington and almost as large as their combined value, as shown by the following table compiled from publications of the Department of Commerce:

MAGNESITE PRODUCTION IN THE UNITED STATES, 1923 TO 1927 INCLUSIVE

	California			Washington			Total			Imported (calcined only)*		
Year	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Short tons	Value	Value per ton
1923	73,350	$938,600	$12.80	73,900	$165,100	$2.24	147,250	$1,103,700	$7.49	72,955	$1,022,968	$14.10
1924	67,240	901,000	13.40	52,860	139,600	2.65	120,100	1,041,300	8.67	64,785	1,172,403	18.10
1925	64,600	872,100	13.50	56,060	560,600	10.00	120,660	1,432,700	11.30	68,395	1,160,830	17.00
1926	53,940	604,130	11.21	79,560	596,700	7.50	133,500	1,200,830	9.00	90,293	1,438,765	15.95
1927	43,750	507,500	11.60	77,740	583,050	7.55	121,490	1,090,550	9.00	59,261	946,361	16.00

*Crude imported in 1927 was 856 tons valued at $8,574.

Portland Cement Production in November

Shipments 2.9% Above Those of November, 1927—Year's Production to End of November 3,600,000 Bbl. More Than Same Period in 1927

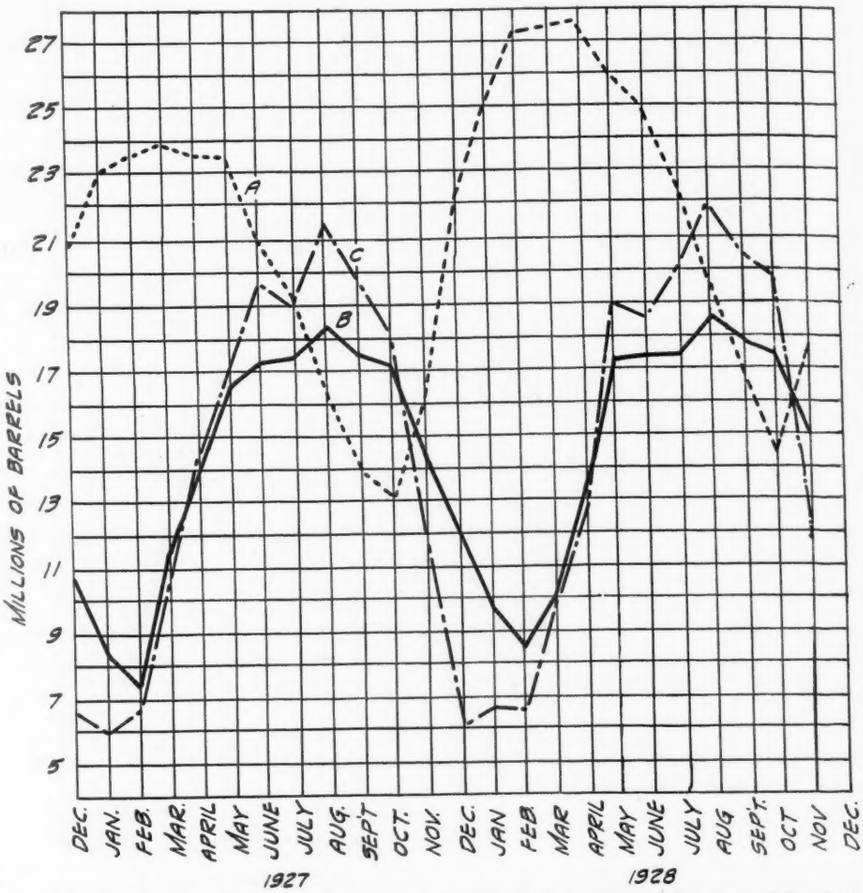
THE PORTLAND CEMENT INDUSTRY in November, 1928, produced 15,068,000 bbl., shipped 11,951,000 bbl. from the mills and had in stock at the end of the month 17,696,000 bbl., according to the United States Bureau of Mines, Department of Commerce. The production of portland cement in November, 1928, showed an increase of 4.3% and shipments an increase of 2.9%, as compared with November, 1927. Portland cement stocks at the mills were 10.4% higher than a year ago. The total production from January to November, 1928, inclusive, amounts to 163,637,000 bbl., compared with 159,909,000 bbl. in the same period of 1927, and the total shipments from January to November, 1928, inclusive, amount to 168,071,000 bbl., compared with 164,722,000 bbl. in the same period of 1927.

The statistics here presented are compiled from reports for November from all manufacturing plants except two, for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 159 plants at the close of November, 1928, and of 154 plants at the close of November, 1927.

RELATION OF PRODUCTION TO CAPACITY

	Nov. 1928 Pct.	Nov. 1927 Pct.	Oct. 1928 Pct.	Sept. 1928 Pct.	Aug. 1928 Pct.
The month	77.4	75.9	87.1	91.7	93.1
12 months ended	74.1	73.7	73.8	73.7	73.5



(A) Stocks of finished portland cement at factories; (B) Production of finished portland cement; (C) Shipments of finished portland cement from factories

PRODUCTION AND STOCKS OF CLINKER, BY MONTHS, IN 1927 AND 1928 (IN BARRELS)

Month	1927—Production—1928		Stocks at end of month 1927	Stocks at end of month 1928
January	10,410,000	11,839,000	9,989,000	9,672,000
February	9,253,000	11,363,000	11,943,000	12,237,000
March	12,397,000	12,501,000	12,997,000	14,463,000
April	14,246,000	13,844,000	13,335,000	15,002,000
May	15,677,000	16,025,000	12,514,000	14,329,000
June	15,437,000	15,940,000	10,926,000	12,944,000
July	15,697,000	15,981,000	9,609,000	11,707,000
August	16,396,000	16,202,000	7,887,000	9,357,000
September	15,931,000	15,909,000	6,490,000	7,566,000
October	16,469,000	15,782,000	5,960,000	*5,944,000
November	14,698,000	14,930,000	6,374,000	5,953,000
December	13,177,000	.....	7,660,000	.....

*Revised.
†Maine began producing in April, 1928, and shipping in May, 1928.

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN SEPTEMBER AND OCTOBER, 1927 AND 1928 (IN BARRELS)*

Shipped to	1927—September—1928		1927—October—1928	
Alabama	229,592	255,120	268,221	226,835
Alaska	742	277	0	132
Arizona	38,589	56,940	40,461	60,063
Arkansas	87,996	136,794	92,180	126,798
California	1,114,333	1,020,406	1,170,744	1,145,337
Colorado	107,896	140,150	120,300	114,600
Connecticut	257,188	233,257	214,120	259,374
Delaware	58,667	34,578	34,107	73,582
District of Columbia	100,626	81,703	97,408	133,450
Florida	152,129	98,859	153,713	142,911
Georgia	149,740	155,421	153,271	180,537
Hawaii	11,790	21,378	23,201	34,436
Idaho	29,588	30,886	32,774	28,253
Illinois	1,902,780	2,553,958	1,892,207	2,130,249
Indiana	807,523	847,440	701,944	658,331
Iowa	563,779	738,450	527,340	442,740
Kansas	261,769	272,461	305,427	316,943
Kentucky	245,577	211,690	223,764	203,725
Louisiana	129,457	112,202	131,902	106,819
Maine	63,493	79,289	49,167	72,694
Maryland	285,248	227,573	258,427	307,849
Massachusetts	310,562	315,939	302,248	337,880
Michigan	1,459,078	1,692,432	1,270,331	1,449,956
Minnesota	414,197	377,096	345,054	306,698
Mississippi	92,276	129,970	105,002	133,253
Missouri	489,155	554,767	502,478	583,508
Montana	43,797	59,124	35,507	52,977
Nebraska	195,109	159,659	207,301	174,041
Nevada	4,845	13,635	5,381	9,954
New Hampshire	66,537	72,947	53,052	73,003
New Jersey	960,390	884,759	870,585	1,064,536
New Mexico	23,103	27,552	29,552	37,837
New York	2,703,962	2,398,193	2,119,748	2,445,879
North Carolina	303,283	167,910	302,904	238,528
North Dakota	35,938	43,739	27,700	41,390
Ohio	1,406,311	1,410,196	1,284,751	1,312,086
Oklahoma	329,676	361,360	301,163	314,273
Oregon	127,909	132,521	122,443	120,863
Pennsylvania	1,683,405	1,519,073	1,413,406	1,651,472
Porto Rico	.....	500	500	.....
Rhode Island	76,597	77,316	71,567	87,953
South Carolina	100,262	108,575	112,445	154,004
South Dakota	56,882	58,274	57,753	52,621
Tennessee	253,945	353,282	231,850	344,413
Texas	449,994	515,419	523,015	564,578
Utah	43,021	49,468	41,022	51,793
Vermont	71,529	108,095	52,392	107,388
Virginia	197,320	173,104	181,685	220,617
Washington	264,748	291,994	220,784	261,412
West Virginia	250,542	166,816	205,074	170,134
Wisconsin	711,004	791,171	541,528	622,618
Wyoming	19,223	27,555	15,102	17,682
Unspecified	38,980	41,593	1,954	8,545
	19,782,082	20,392,866	18,045,955	19,777,550
Foreign countries	45,918	67,134	59,045	58,450
Total shipped from cement plants	19,828,000	20,460,000	18,105,000	19,836,000

*Includes estimated distribution of shipments from three plants each month.

to be exhibited at—

1929 Road Show—Cleveland

January 14th — 18th

Newhouse Style "B" Crusher *for* High Capacity and Low Crushing Costs

MODERN requirements demand low crushing costs which are governed by the ability of the crushing equipment to produce high capacities per crushing unit. The Allis-Chalmers Newhouse Style "B" Crusher, with its large receiving opening, short rigid main shaft and rapid crushing stroke, meets these requirements. The result of this high speed crushing stroke is high capacity with a uniform product at a minimum of power per ton of material crushed. The machine is self-contained with vertical motor.

The forged steel heat treated main shaft is of heavy proportions, hollow bored for strength and passage of the drive shaft from the motor.

Lubrication is by external motor driven centrifugal pump with oil filter and cooler. The crusher is of heavy construction to meet the most severe crushing conditions. Concaves are reversible end for end. The machine is arranged for three point suspension by cables to the framework of the building, thus saving building space and foundation expense and eliminating building vibration.

The perfected Allis-Chalmers Newhouse Style "B" Crusher is the result of over seven years' work and study during which time all problems have been solved.

Made in three sizes:
7", 10", 14" receiving opening.

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PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN NOVEMBER, 1927 AND 1928, AND STOCKS IN OCTOBER, 1928 (IN BARRELS)

District	Production 1927—Nov.—1928		Shipments 1927—Nov.—1928		Stocks at end of month 1927—Nov.—1928		Stocks at end of Oct. 1928*
East'n Penn., N. J. and Md...	3,345,000	3,338,000	3,008,000	3,153,000	3,765,000	4,196,000	4,011,000
New York and Maine†	804,000	962,000	741,000	725,000	1,205,000	1,339,000	1,102,000
Ohio, West'n Penn., W. Va...	1,542,000	1,587,000	986,000	1,133,000	2,069,000	2,439,000	1,985,000
Michigan	1,181,000	1,409,000	757,000	811,000	1,501,000	1,355,000	757,000
Wis., Ill., Ind. and Ky.	1,909,000	1,973,000	1,284,000	1,272,000	1,512,000	1,624,000	924,000
Va., Tenn., Ala., Ga., Fla., La...	1,452,000	1,413,000	1,325,000	1,350,000	1,304,000	1,683,000	1,619,000
E'n Mo., Ia., Minn., S. Dak...	1,411,000	1,283,000	677,000	777,000	1,724,000	1,972,000	1,470,000
W'n Mo., Neb., Kan., Okla...	883,000	884,000	830,000	726,000	1,265,000	1,150,000	993,000
Texas	525,000	529,000	543,000	451,000	252,000	424,000	346,000
Colo., Mont. and Utah	176,000	238,000	175,000	145,000	315,000	398,000	304,000
California	1,048,000	1,173,000	1,103,000	1,103,000	776,000	757,000	687,000
Oregon and Washington	173,000	279,000	190,000	305,000	334,000	359,000	385,000
	14,449,000	15,068,000	11,619,000	11,951,000	16,022,000	17,696,000	14,579,000

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1927 AND 1928 (IN BARRELS)

Month	1927—Production—1928		1927—Shipments—1928		Stocks at end of month 1927	1928
January	8,258,000	9,768,000	5,968,000	6,541,000	22,914,000	25,116,000
February	7,377,000	8,797,000	6,731,000	6,563,000	23,563,000	27,349,000
March	11,450,000	10,223,000	11,100,000	10,135,000	23,922,000	27,445,000
April	14,048,000	13,468,000	14,350,000	13,307,000	23,654,000	27,627,000
May	16,701,000	17,280,000	16,865,000	18,986,000	23,503,000	25,984,000
June	17,224,000	17,469,000	19,761,000	18,421,000	20,972,000	25,029,000
July	17,408,000	17,445,000	18,984,000	19,901,000	19,397,000	22,580,000
August	18,315,000	18,730,000	21,411,000	21,970,000	16,292,000	19,374,000
September	17,505,000	17,856,000	19,828,000	20,460,000	13,996,000	16,799,000
October	17,174,000	17,533,000	18,105,000	19,836,000	13,141,000	*14,579,000
November	14,449,000	15,068,000	11,619,000	11,951,000	16,022,000	17,696,000
December	11,999,000	.....	6,200,000	.....	22,082,000	.....
	171,908,000	.....	170,922,000	.....	.....	.....

PRODUCTION AND STOCKS OF CLINKER (UNGROUND CEMENT), BY DISTRICTS, IN NOVEMBER, 1927 AND 1928 (IN BARRELS)

District	1927—Production—1928		Stocks at end of month 1927	1928
Eastern Pennsylvania, New Jersey and Maryland	3,402,000	3,151,000	877,000	702,000
New York and Maine†	841,000	1,035,000	341,000	725,000
Ohio, Western Pennsylvania and West Virginia	1,631,000	1,568,000	732,000	528,000
Michigan	1,243,000	1,291,000	505,000	440,000
Wisconsin, Illinois, Indiana and Kentucky	1,926,000	2,029,000	309,000	283,000
Virginia, Tenn., Alabama, Georgia, Florida, Louisiana	1,431,000	1,409,000	689,000	722,000
Eastern Missouri, Iowa, Minnesota, South Dakota	1,383,000	1,325,000	400,000	350,000
Western Missouri, Nebraska, Kansas and Oklahoma	861,000	915,000	214,000	338,000
Texas	516,000	540,000	176,000	131,000
Colorado, Montana and Utah	121,000	243,000	400,000	320,000
California	1,140,000	1,157,000	1,354,000	1,143,000
Oregon and Washington	203,000	267,000	377,000	271,000
	14,698,000	14,930,000	6,374,000	5,953,000

Exports and Imports

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN OCTOBER, 1928

Exported to	Barrels	Value
Canada	4,921	$ 22,621
Central America	1,842	5,280
Cuba	5,194	15,855
Other West Indies	8,381	19,053
Mexico	7,089	23,644
South America	25,091	102,307
Other countries	9,619	57,250
	62,137	$246,010

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS IN OCTOBER, 1928

Imported from	District into which imported	Barrels	Value
Belgium	Florida	987	$ 1,013
	Galveston	3,500	3,988
	Los Angeles	510	615
	Massachusetts	34,124	56,877
	New Orleans	2,489	4,034
	New York	12,500	18,575
	North Carolina	21,036	35,179
	Rhode Island	17,750	23,349
	Sabine	1,500	2,850
	South Carolina	20,000	24,146
	Total	114,396	$170,626
Canada	Me. & N. H.	4,015	$ 9,148
	New York	10,106	15,649
	Philadelphia	2,724	5,149
	San Francisco	3	17
	Total	16,848	$ 29,963
Denmark	New York	9,124	$ 9,500
	Porto Rico	9,356	11,583
	Total	18,480	$ 21,083
France	New York	998	$ 2,200
Germany	Los Angeles	1,485	$ 3,003
Irish Free State	New York	3	$ 34
	Grand total	152,210	$226,909

Inland Steel Company Purchases Large Limestone Operation

A TRANSACTION that is of extreme interest and one that will no doubt act as a stimulant to the entire industry is that recorded by the *Manistique* (Mich.) *Pioneer Tribune*, dated Dec. 13, 1928.

"The Inland Steel Company announces the organization of a new corporation for the production of chemical and metallurgical limestone to be known as 'Inland Lime & Stone Company.' The project will be located in the eastern end of the northern peninsula of Michigan, about 25 miles east of the city of Manistique The negotiations which have led up to this transaction have been carried on for some time with Manistique Lime & Stone Company, whose business will be taken over and continued, and whose stockholders will retain an interest in the new company. During the past year a campaign of exploration by diamond drilling has been conducted on the lands owned or held under option by the Manistique company and George J. Nicholson personally, and a very large tonnage of high calcium limestone has been proven up. In developing the project a large quarry will be opened, a railroad will be constructed to Lake Michigan, and a crushing and screening plant with suitable harbor and dock facilities will be constructed in the vicinity of Seul Choix Point, making the limestone available for transportation in lake vessels. Stone will be produced not only for use in the steel industry, but also for chemical purposes such as the paper industry, in which the Manistique company has already built up a substantial business. That phase of the project will continue to be managed by George J. Nicholson, and his assistants, Mr. Gordon Hughes and Mr. Walter Moon, who are responsible for the recent growth and expansion of the Manistique company. The opening of the new quarry and the construction and operation of the new plant will be in charge of A. J. Cayia, who for the past four years has been superintendent of the Wakefield Mine for the M. A. Hanna Co. on the Gogebic Range in Michigan. The directors of Inland Lime & Stone Company will be P. D. Block, L. E. Block, David P. Thompson, Clarence B. Randall, Geo. J. Nicholson, Gorden Hughes, and I. N. Bushong. The officers will be: President, David P. Thompson; assistant to the president, C. B. Randall; vice-president, Geo. J. Nicholson; secretary-treasurer, W. D. Truesdale, and Walter M. Moon, assistant treasurer.

"It is expected that the new plant will be put into operation during the latter part of the season of 1930."

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII AND PORTO RICO, IN OCTOBER, 1928

	Barrels	Value
Alaska	816	$ 2,592
Hawaii	25,948	59,124
Porto Rico	4,625	11,298
	31,389	$73,014

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1927 AND 1928

Month	1927—Exports—1928 Barrels	Value	Barrels	Value	1927—Imports—1928 Barrels	Value	Barrels	Value
January	75,346	$254,072	56,400	$204,875	193,175	$269,661	234,753	$342,797
February	71,404	233,985	62,828	221,620	130,421	200,680	164,408	217,525
March	67,956	240,165	74,983	265,719	181,145	261,519	235,930	330,074
April	72,383	243,832	61,676	205,882	192,318	313,262	249,458	324,371
May	59,332	205,574	70,173	236,005	178,929	263,618	190,509	256,872
June	69,205	237,281	59,536	201,313	129,111	201,682	266,537	359,637
July	72,337	249,737	83,759	291,055	175,042	249,665	112,887	151,877
August	61,371	209,198	88,736	302,866	117,605	170,167	259,988	358,858
September	57,890	207,817	71,995	252,843	233,066	304,796	173,439	226,295
October	67,639	230,668	62,137	246,010	221,274	321,777	152,210	226,909
November	79,764	257,428	.....	.....	141,485	190,419	.....	.....
December	62,099	226,960	.....	.....	156,609	209,205	.....	.....
	816,726	$2,796,717	.....	.....	2,050,180	$2,956,451	.....	.....

Lime Concrete

IN our German contemporary, *Beton und Eisen*, a brief description is given of a new building material. This, which is called "Warmbeton" (hot concrete), is a lime concrete to which a definite proportion of cement is added, and is placed while still hot from the slaking. It is stated to be quick setting, sound, weather resistant and somewhat elastic.—*The Concrete Journal* (London, England).